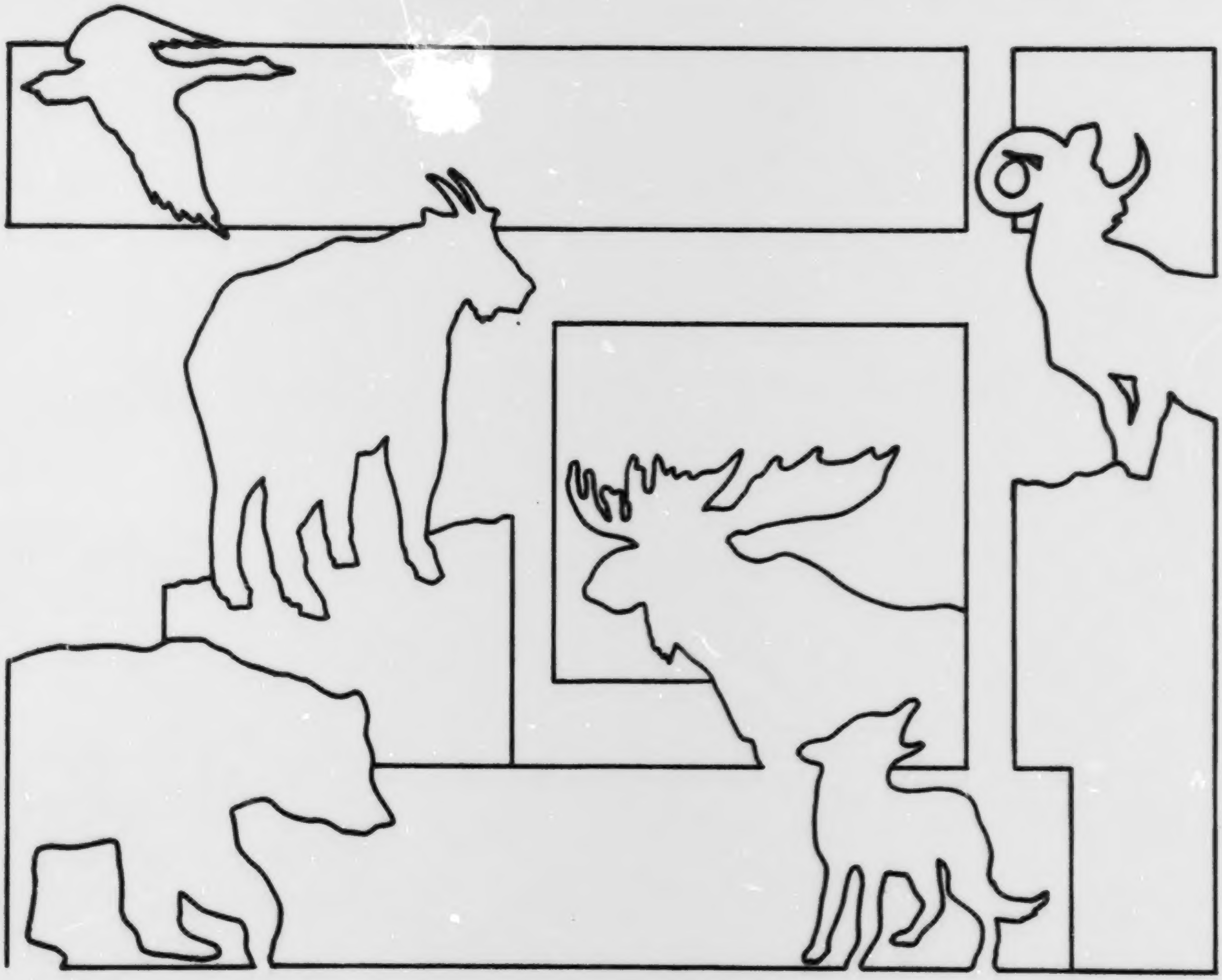
WILDLIFE

Furbearer Inventory, Habitat Assessment and Trapper Utilization of the Yukon River Basin

Project Report: Wildlife No. 1



YUKON RIVER BASIN STUDY

This project was completed for the Yukon River Basin Study, an intergovernmental study funded by the governments of Canada, Yukon and British Columbia.

Yukon
Department of Renewable Resources

25

YUKON RIVER BASIN STUDY

PROJECT REPORT: WILDLIFE NO. 1

FURBEARER INVENTORY, HABITAT ASSESSMENT AND TRAPPER UTILIZATION OF THE YUKON RIVER BASIN

B.G. Slough and R.H. Jessup

Wildlife Management Branch
Yukon Department of Renewable Resources
Box 2703
Whitehorse, Yukon Y1A 2C6

January 1984

This report was funded by the Yukon River Basin Committee (jointly with Yukon Department of Renewable Resources) under the terms of "An Agreement Respecting Studies and Planning of Water Resources in the Yukon River Basin" between Canada, British Columbia and Yukon. The views, conclusions and recommendations are those of the authors and not necessarily those of the Yukon River Basin Committee or the Government of Canada, British Columbia and Yukon.

ABSTRACT

The Yukon Department of Renewable Resources conducted furbearer inventory studies in the Canadian Yukon River Basin in 1982 and 1983. Field studies included beaver (Castor canadensis) food cache and colony site surveys, winter track-count sampling and muskrat (Ondatra zibethica) pushup surveys. Data from the surveys were analyzed in conjunction with ongoing trapper questionnaire and historical fur harvest data sources to characterize furbearer population distributions, levels, trends and habitats. Historical and present fur harvest and trapping activity are described. The fur resource capability and problems and issues associated with impacts on furbearer populations, habitats and user groups are discussed.

The populations of wolves Canis lupus, red fox Vulpes fulva, coyote C. latrans, red squirrel Tamiasciurus hudsonicus, weasel Mustela erminea, marten Martes americana, mink Mustela vison, otter Lutra canadensis, wolverine Gulo luscus, beaver, muskrat and lynx Lynx canadensis are all widely distributed within the Yukon River Basin. Some local absences were noted: coyotes are rare east of the Pelly River and marten are rare in the southern Yukon between Kluane Lake and Teslin Lake. The marten absence is believed to have been caused by a combination of overharvest and fires (in 1958) and sustained by trapping pressure which is preventing recolonization of the maturing habitat. All populations (except marten) are believed to be healthy within the context of "available" habitat for each species and acknowledging the effect of population cycles. Two major prey species, grouse and snowshoe hare, were also monitored during

the studies. Both species have been at the low point of their cycles since population crashes in 1981 (grouse; mainly spruce and ruffed grouse, Canachites canadensis and Bonasa umbellus) and 1982 (hares Lepus americanus). Their predators are still abundant, although will probably decline extensively in 1983-84 and for the following one or two years when natural and trapping mortality will exceed recruitment into the population (recruitment diminishes when animals are stressed with a food shortage). Lynx will exhibit the greatest decline. Fox, coyote and wolverine will also be directly affected but to a lesser degree, and other species may receive secondary impacts as prey shifts occur. Long distance movements and movements through sub-optimal habitats were noted for wolverine and lynx in 1982-83 indicating a food stress on these species. Wolverine, lynx and marten are harvested near the upper limit of a sustainable harvest. Trappers are being made aware of their responsibility to manage furbearers through an education program. Muskrats are declining in their already sparcely distributed habitat in a phase of an apparently natural cycle. Furbearer populations and their harvests are being continually monitored through ongoing programs.

The value of the fur harvest of the River Basin exceeded $1 million for the first time in 1982. Lynx contributed 82% of this total. Other economically significant species include marten (8%), fox (4%), wolverine (1%), mink (1%) and squirrel (1%). The River Basin Harvest comprised 78% of the total Yukon fur Harvest (1982). Some 350 to 400 trappers are annually employed (part-time or full time) by trapping

in the River Basin. There are 299 registered trapping concessions, 8 radius areas around communities and 3 group areas. Resident and non-resident hunters who are permitted to hunt wolves, coyotes and wolverines annually harvest about 85, 20 and 15 individuals respectively.

Potential impacts on furbearer populations and trapping activities include permanent or temporary habitat loss, air and water pollution, and disturbance. Permanent habitat loss is seen as the most severe impact and hydroelectric development as the scenario threatening the greatest habitat loss.

An annotated bibliography and information summary on the furbearer resource and trapping industry of the Yukon River Basin is appended. One hundred and fifty-four documents were annotated and indexed by subjects.

Table of Contents

Abstract ii
List of Tables vii
List of Figures viii
Acknowledgements 1
Introduction 4

Methods

    Beaver Studies 8
    Muskrat Pushup Surveys 11
    Winter Track-Count Surveys 15
    Fur Harvest Monitoring 19
    Trapper Questionnaire 20

Results and Discussion

    Trapper Questionnaire 22

    Populations, Trends, Habitats

        Beaver 34
        Muskrat 39
        Winter Track-Counts 42

    Trapping

        Historical and Present Fur Resource Utilization 65
        Resource Capability 74
        Resource Conflicts 77
        Management Recommendations 84
Literature Cited 86

Appendix I

Map 1 Trapping Concessions
Map 2 1982 and 1983 Beaver Food Cache Survey Results
Map 3 Observed Muskrat Pushup Density 1982
Map 4 Observed Muskrat Pushup Density 1983

Appendix II

Annotated Bibliography and Information Summary on the Furbearer Resource and Trapping Industry of the Yukon River Basin

-by C.M.M. Smits

List of Tables

Table Page

1. Furbearer Population Level and Trend Indices for Yukon River Basin Study Area from Yukon Trapper Questionnaire. 23

2. Summary of 1983 Population Indices. 32

3. 1982-83 Beaver Colony Densities 35

4. 1982 Muskrat Pushup Survey Results 40

5. 1983 Muskrat Pushup Survey Results 41

6. Summary of Winter Track-Counts 43

7. Relative Abundance Indices of Furbearers and Utilization-Availability of the Study Areas. 45

8. Example of Utilization-Availability Analysis 46

9. Canopy Cover Utilization 48

10. Terrain Utilization 49

11. Slope Aspect Utilization 50

12. Snow Depth Utilization 51

13. Activity at Ambient Temperatures 52

14. Temporal Activity Patterns 53

15. Vegetation Type Utilization 54

16. Total Yukon Fur Production 68

17. Fur Harvest and Dollar Value of the Harvest from the Yukon River Basin for Seven Years. 70

18. Comparison of Fur Harvest Nominal Dollar Value between the Yukon River Basin and the Total Yukon Territory. 72

List of Figures

Figure		Page
1.	Yukon River Basin in Canada Study Area	7
2.	Beaver Food Cache Surveys - 1982	9
3.	Beaver Food Cache Surveys - 1983	10
4.	Muskrat Pushup Surveys - 1982	13
5.	Muskrat Pushup Surveys - 1983	14
6.	Winter Track-count Data Form	17
7.	Winter Track-count Study Areas	18

ACKNOWLEDGEMENTS

Principal funding for the field studies and annotated bibliography was provided by the Yukon River Basin Study ($103,000). Canada Department of Indian Affairs and Northern Development and the MacPass Task Force co-funded the 1981-82 surveys in the North Canol area ($16,000 and $6,000 respectively). The Yukon Department of Renewable Resources conducted all studies, providing the majority of logistical and technical support. The historical fur harvest and trapper questionnaire data are collected through ongoing Yukon Government projects.

We would like to thank the many persons involved with us in the field surveys. They include

Winter Track-Surveys (all casual technicians)
    Rhonda Markel, Paul Henstridge - North Canol 1982
    Patricia Denison, David Milne - Southern Lakes 1982
    Chris Wedeles, Duncan Ruckston - Kluane 1982
    Robbin Hunka, Mike Rourke - North Canol 1983
    Cliff Geddes, Art Johns - Southern Lakes 1983
    Scott Gilbert, Richard Ward - Kluane 1982-83

Muskrat Pushup Surveys
1982 - Philip Merchant - Y.T.G. Lab Technician
    Melanie Courchene - Y.T.G. Conservation Officer
    Rhonda Markel - Casual Technician
    Patricia Denison - Volunteer
1983 - Beth Ereaux - Y.T.G. Habitat Biologist

Beaver Cache Surveys

1982 - Beth Ereaux - Y.T.G. Habitat Biologist

1983 - Steve Beare - Volunteer

Monty Gosselin - Y.T.G. Conservation Officer

Ron Sumanik - Casual Technician

The pilots, who flew skilful and safe surveys and provided invaluable spotting assistance were:

Kerry Guenter - Cassiar Airways

Steve McNab - Yukon Airways

Denny Denison - Coyote Air

Barry Watson - Alkan Air

Peter Kelly - Trans North Turbo Air

We had the support of many other Y.T.G. staff in various aspects of the work. The most difficult working conditions encountered on the surveys were during winter on the North Canol Road. The Yukon Highways maintenance staff in Ross River and at the Twin Creeks maintenance camp accommodated our snow machine problems, provided a temporary base for the wildlife trailer and generally supported our winter operations. The R.C.M.P. provided their trailer at Dewhurst Creek for use on extended surveys on the upper S. MacMillan River. Kris Gustafson (Y.T.G. Conservation Officer) supported our work throughout, being most valuable during the winter of 1983 on the North Canol.

We are also grateful to proprietors and employees of local Yukon support services, who made us feel welcome and expedited our work in their communities.

Cor Smits (Y.T.G. casual research assistant) prepared the annotated bibliography.

Our sincere thanks also go to Thom Rogers, who prepared the graphics, and to our typist, Linda Nykiforuk, who also acted as an interpreter of Harvey's writing.

Lastly, the Yukon River Basin Committee provided the guidance and direction so important to the successful completion of our work.

INTRODUCTION:

Furbearer management in Yukon consists primarily of population monitoring by the government, self-regulation of harvest by the trapper, and trapper education and liason as a line of communication between the two. The registered trapline system disburses trapping effort across the Territory and bestows each trapper with the responsibility to manage the populations on his trapping area. Information from monitoring and other studies is passed on to the trapper in an effort to achieve trapline management, thus reducing the need for regulating the industry. As monitoring programs are developed, Y.T.G. will have the ability to protect rare or endangered species, overharvested species, or species which have suffered population declines through habitat destruction or biological causes, by regulation of open seasons and quotas. The open seasons are currently set to restrict the harvest to prime pelts. Compromises have been made to permit the socially oriented late spring harvest of beaver and muskrats and the sport hunting of wolverines, wolf and coyote.

This study was necessitated by a data base which was insufficient for purposes of multiple land-use planning in the Yukon River Basin context. The furbearers were seen as priority species for management concerns by the Wildlife Work Group (Technical Advisory Group, Yukon River Basin Committee).

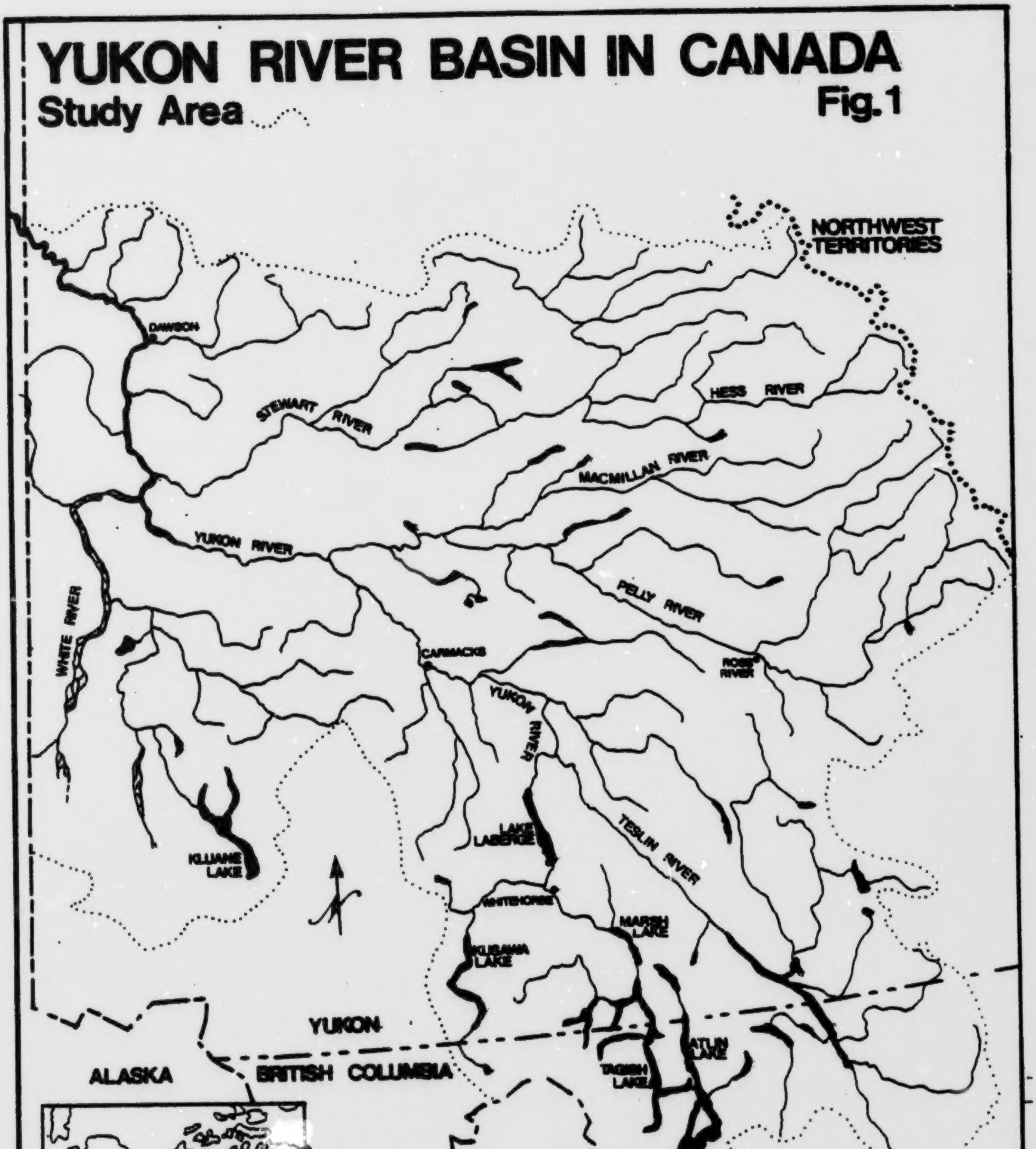
The objectives of the present study are outlined below from the perspective of providing information for the planning process. As a wildlife management agency we, of course have other uses for the information, as stated at the outset.

Objectives:

1. Inventory furbearer habitat and existing populations in the Yukon River Basin.
2. Identify critical and sensitive furbearer habitats and populations.
3. Estimate the capacity of the area to support furbearers and trapping activities.
4. Determine the present and historical use (harvest) of the furbearer populations.
5. Identify conflicts which developments may impose on trapping activities.
6. Propose mitigation measures and management strategies.

This paper, then, presents data from furbearer population and harvest monitoring programs in place at present in the Yukon River Basin. The major inventory was accomplished with River Basin Study funding during 1982 and 1983. Inventory began in the North Canol Area in 1981. This work was reported to the end of 1982 by Slough (1983). The trapper questionnaire program has been collecting information annually since 1977, and the historical fur harvest data system has been in place in varied forms since 1920. Area-specific harvest estimates are available only from 1950. We also give a discussion of the fur resource capability, historical and present trapping activity and value of the fur harvest, and conflicts between the furbearer populations and user groups, and other resource developments.

The study area encompasses the entire watershed of the Yukon River in Yukon and British Columbia, excluding those tributaries which enter the Yukon below (west of) the United States-Canada boundary. (see Figure 1).



YUKON RIVER BASIN IN CANADA

Study Area

Fig.1

NORTHWEST TERRITORIES
DAWSON
STEWART RIVER
HESS RIVER
MACMILLAN RIVER
YUKON RIVER
PELLY RIVER
WHITE RIVER
CARMACKS
ROSS RIVER
YUKON RIVER
LAKE LABERGE
TESLIN RIVER
KLUANE LAKE
WHITEHORSE
MARSH LAKE
KUSAWA LAKE
YUKON
ATLIN LAKE
TAGISH LAKE
ALASKA
BRITISH COLUMBIA
STUDY AREA
50 0 50 MI.
50 0 100km

METHODS

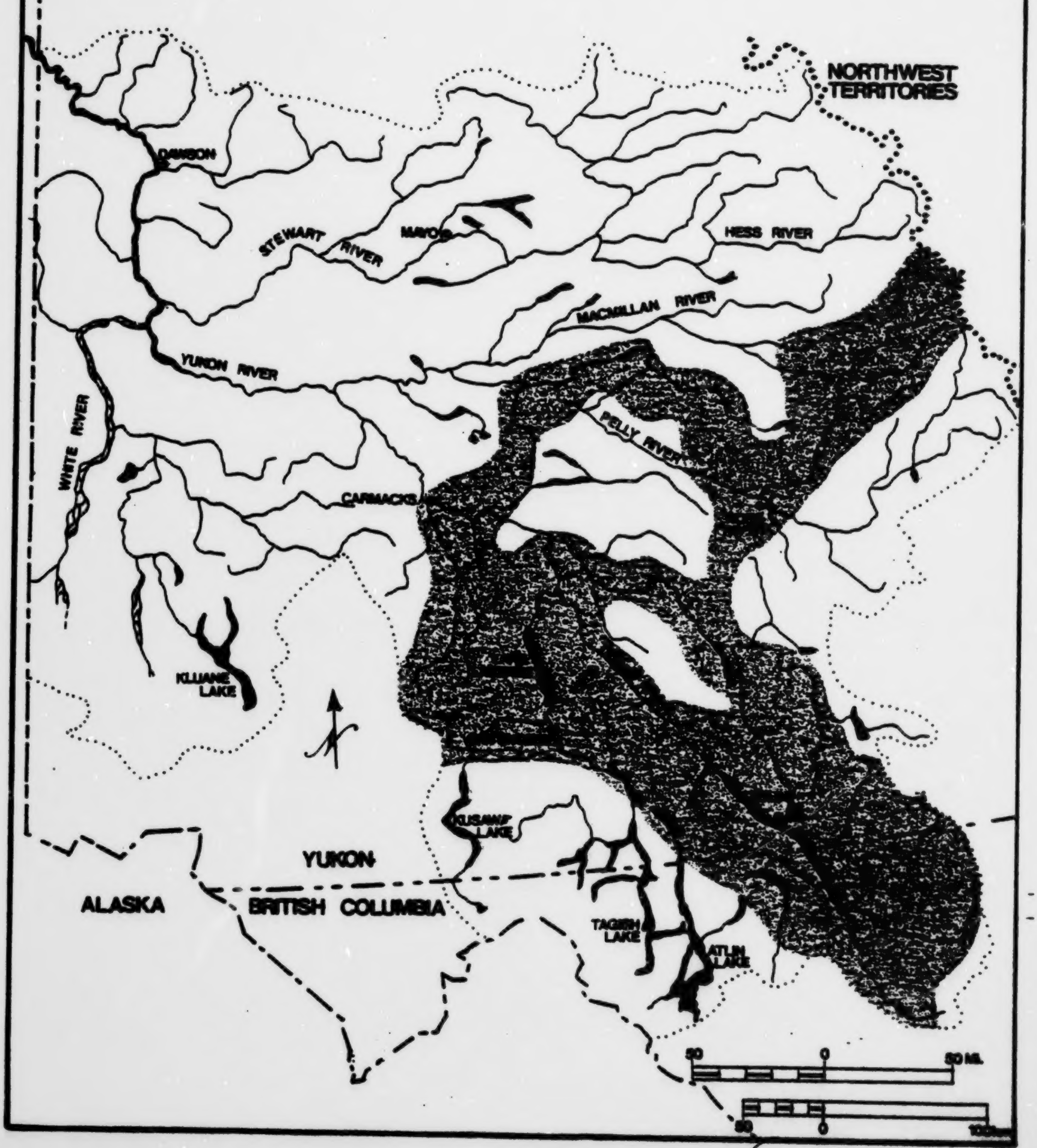
Beaver Studies

Beaver (Castor canadensis) food cache surveys provide a census of all active beaver colony sites in the survey area. Before freezeup, beaver colonies, which are discrete social units within the population, build caches (or feed piles) in the water near their lodges. The caches are most visible from the air after leaf-fall and before freeze-up. Each cache represents one colony. A factor may be applied to the number of caches in order to estimate actual numbers of beavers in the population. The usual figure is five, although beaver studies in Alaska and northern Saskatchewan have shown that this figure may be low for higher quality habitats in northern latitudes.

The 1982 cache surveys were flown September 21 to October 2, using a Hillar 12-E helicopter.(Figure 2). The 1983 surveys were flown on October 5 in a Hughes 500C helicopter. (Figure 3). One navigator/observer and one other observer accompanied the pilot. The surveys were flown at 100 to 150 k.p.h. at heights averaging 100 metres above ground level. Siteability of active colonies was close to 100% using this method. All active and inactive colony sites were recorded on 1:250,000 topographic maps. The results were converted to active beaver colony density (km/active colony) on stream reaches, and plotted on a "River Basin" map. (Appendix I, Map 2).

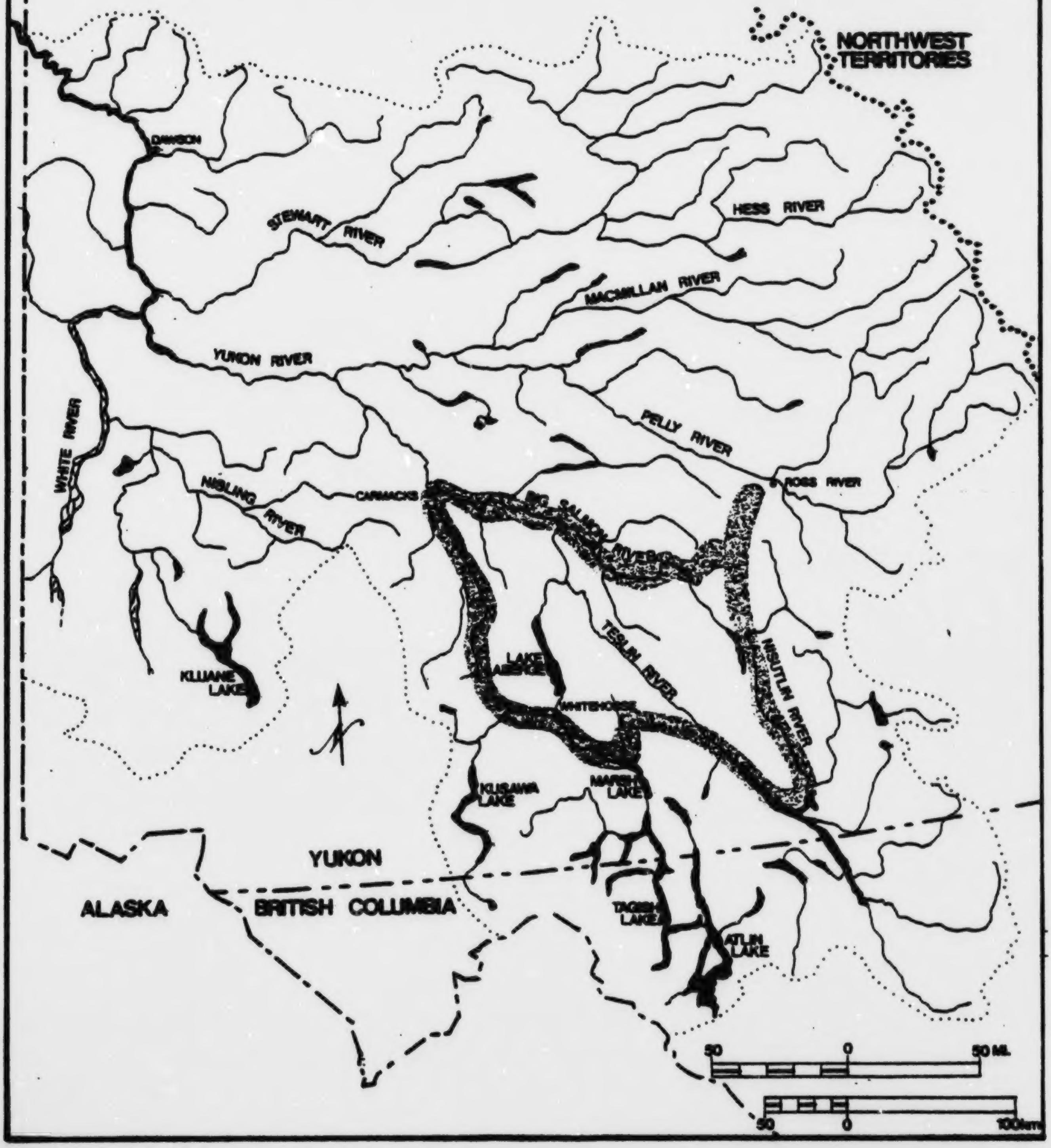
YUKON RIVER BASIN IN CANADA

Beaver Food Cache Surveys 1982 ▨ Fig. 2


NORTHWEST TERRITORIES
DAWSON
STEWART RIVER
MAYO
HESS RIVER
MACMILLAN RIVER
YUKON RIVER
WHITE RIVER
PELLY RIVER
CARMACKS
KLUANE LAKE
KUSAWA LAKE
YUKON
ALASKA
BRITISH COLUMBIA
TAGISH LAKE
ATLIN LAKE
50
0
50 MI.
50
0
100

YUKON RIVER BASIN IN CANADA

Beaver Food Cache Surveys 1983 ▨ Fig. 3


NORTHWEST TERRITORIES
DAWSON
STEWART RIVER
HESS RIVER
MACMILLAN RIVER
YUKON RIVER
PELLY RIVER
WHITE RIVER
NISLING RIVER
CARMACKS
BIG SALMON RIVER
ROSS RIVER
TESLIN RIVER
NISUTLIN RIVER
LAKE LABERGE
KLUANE LAKE
WHITEHORSE
N
KUSAWA LAKE
MARSH LAKE
YUKON
ALASKA
BRITISH COLUMBIA
TAGISH LAKE
ATLIN LAKE
50 0 50 MI.
50 0 100 km

In addition to the 1982 aerial surveys, the Department conducted summer boat surveys on selected streams and lakes in the Ross River drainage (1981), and on the Nisutlin (1981), Wolf and Nordenskiold rivers (1982). Active beaver colonies were also cencused by boat in the fall of 1981 on the Nisutlin river and Lapie-Rose system.

A trapping study was undertaken in 1981 on the Lapie-Rose and Nisutlin rivers to obtain information on colony composition and beaver movements. Results of these and other relevant beaver studies are summarized.

Muskrat Pushup Surveys

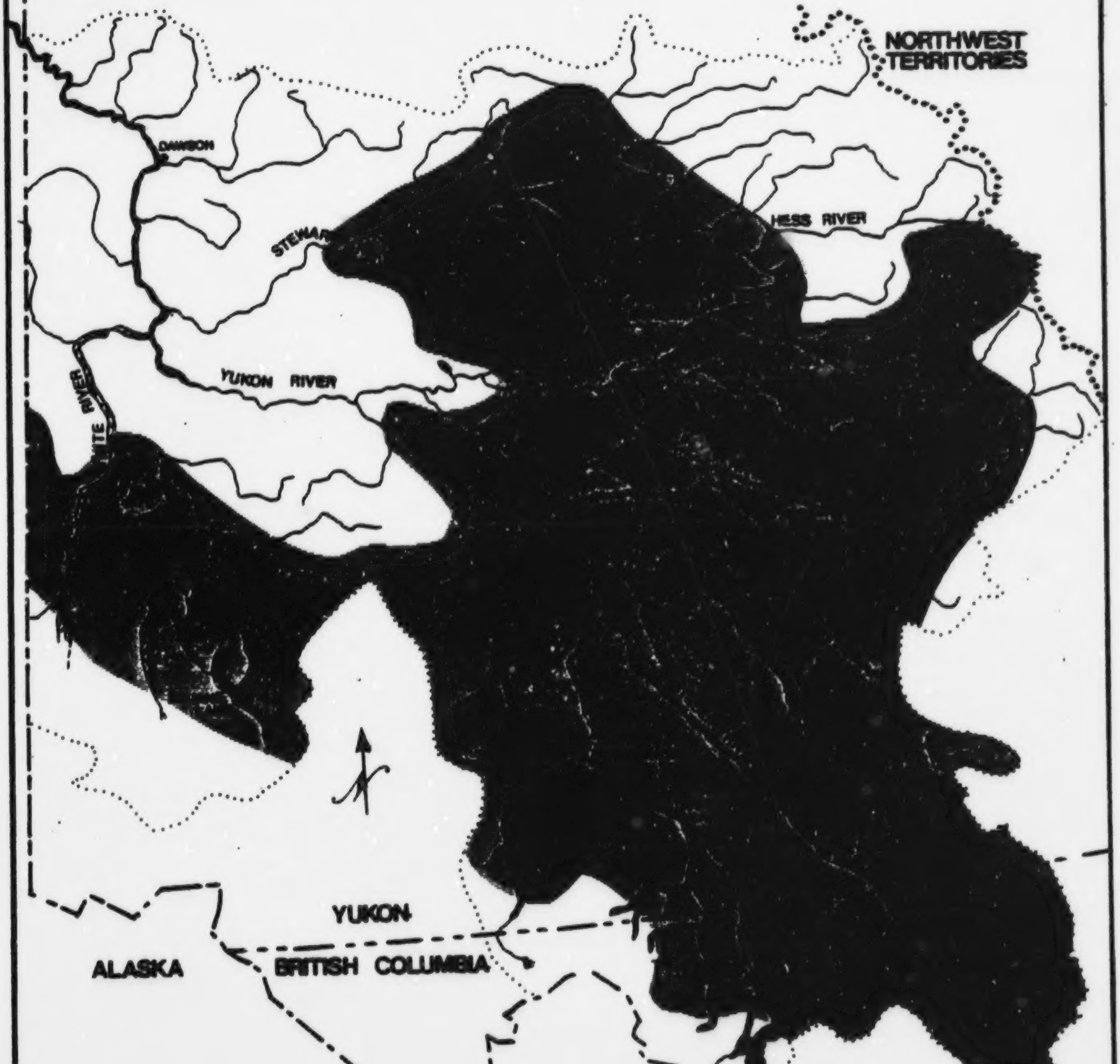
Muskrat (*Ondatra zibethica*) populations are indexed by pushup counts rather than house counts since most muskrats at this latitude occupy bank burrows due to a lack of emergent vegetation needed for house construction and great ice thickness. Pushups, hollow feeding stations constructed on the ice surface, accessible through a "plunge hole" in the ice, are used to extend their foraging range from the bank burrows. The number of active pushups diminishes through the winter months as muskrats die or are trapped, or as pushups are abandoned. On the MacKenzie Delta, groups of three to sixteen rats (average of 6) used each pushup and overwintering groups used two or three pushups each (Stevens 1955). From thirty-three percent to fifty-six percent of pushups constructed in the fall were active in March/April. There is, therefore, a basis, albeit undefined, for the use of pushups as indicators of population levels.

Ideal pushup survey conditions exist when the snow has melted to expose the pushups and before the ice has melted, destroying pushups. When surveying an extensive area, conditions vary with elevation, with lower elevation lakes (below 1000m a.s.l.) showing deteriorating ice conditions (open shorelines) while at higher elevations (above 1500m a.s.l.) winter conditions may still exist with some pushups obscured by snow cover. In the study area the lowlands in the lower Yukon basin below Whitehorse including the White-Donjek basin are the first to open. Although a compromise must be made, survey dates were chosen to provide the best overall survey conditions. The surveys were conducted May 4-24/82 and April 21-26/83. Areas surveyed are shown on Figures 4 and 5.

Muskrat pushup surveys were flown in fixed wing aircraft (Cessna 185II or Maule M-5) about 150m above ground level, at an airspeed of 100 k.p.h.. An observer-navigator was located in the right front seat, with another observer in the left rear seat. Both observers recorded their own observations along a transect 2 km in width (1 km on either side of the aircraft). Transects were generally flown on a route chosen to intercept selected lakes or watercourses, or the largest number of potholes on relatively straight transect. The pilots were instructed to keep smaller potholes on one side of the aircraft or the other, while larger lakes were bisected to obtain complete counts. The transects were plotted on 1:250,000 topographic maps. Observations were coded on the maps.

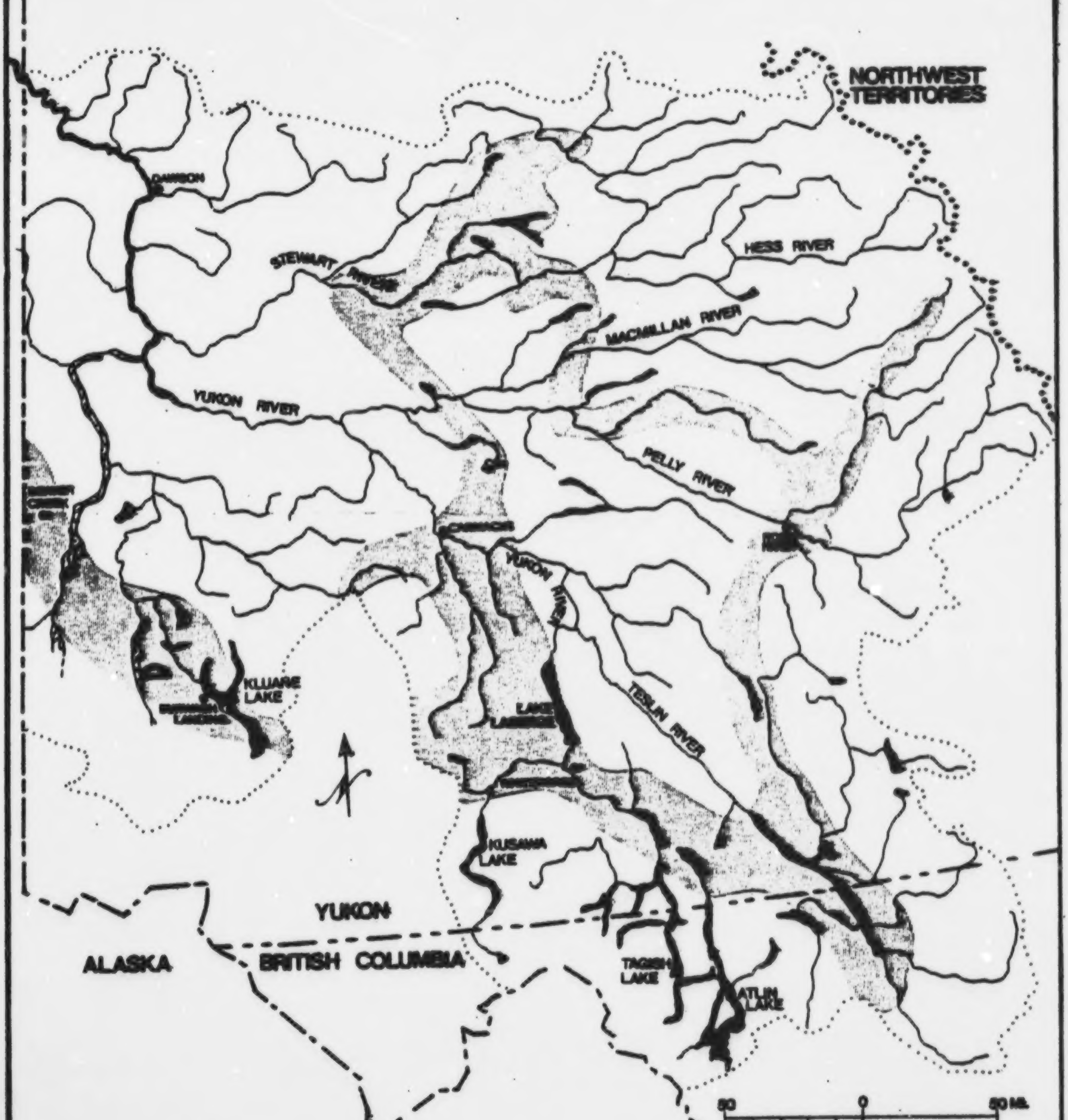
YUKON RIVER BASIN IN CANADA

Muskrat Pushup Surveys 1982 ■ Fig. 4


NORTHWEST TERRITORIES
DAWSON
STEWAR
HESS RIVER
YUKON RIVER
RIVER
ITE
N
YUKON
ALASKA
BRITISH COLUMBIA
50 0 50 MI.
50 0 100 km

YUKON RIVER BASIN IN CANADA

Muskrat Pushup Surveys 1983 ▨ Fig. 5


NORTHWEST TERRITORIES
DAWSON
STEWART RIVER
HESS RIVER
MACMILLAN RIVER
YUKON RIVER
PELLY RIVER
CARMACKS
YUKON RIVER
TESLIN RIVER
KLUANE LAKE
BURWASH LANDING
LAKE LABERGE
KUSAWA LAKE
YUKON
ALASKA
BRITISH COLUMBIA
TAGISH LAKE
ATLIN LAKE
50 0 50 Mi.
50 0 100km

The observed muskrat pushup density was plotted on study area maps using three categories: (Appendix I, Maps 3 and 4)

Low: < 5 pushups/km^2 on isolated wetlands

Moderate: < 5 pushups/km^2 on continuous wetlands

High: ≥ 5 pushups/km^2

Winter Track-Count Surveys

Track-counts are commonly used to describe animal distribution, abundance and population trends. They provide an index of relative abundance of furbearer species which is comparable between geographic areas, habitat types and sample dates. There have been attempts, particularly in the U.S.S.R., to convert track-count densities to animal numbers. Spatial and temporal activity patterns by species (and even by individual members within species) are not consistent enough to allow conversion from tracks/km-day (number of fresh tracks of each species/distance surveyed (km) x days since last snowfall) to animal numbers. Activity patterns will vary depending on habitat and weather conditions, intra- and inter- (predator) specific densities, etc. They do, however, give us an acceptable index of the relative use of habitats by furbearers.

Track-count methodologies have varied considerably depending on information requirements, sampling design, etc. In this study, the division of sampling units (transects) was based on terrain and forest cover types as characterized by major trees/shrubs and understory species. Transects were snowshoed/skied/snowmobiled. Track counts were not repeated on "fixed" transects, rather there was an attempt to randomly sample biophysical habitat types according to availability. The minimum transect length was 1.0 km.

Data recorded during each transect included the number of tracks of each species, the number of days since last snowfall, the vegetation type, canopy cover, terrain, slope aspect, snow depth and temperature (Figure 6). The linear distance of each transect and the U.T.M. coordinates for the start and finish of the transects were taken from 1:250,000 topographic maps. The transects were plotted on the maps.

Three study areas were chosen for intensive sampling. These areas (Figure 7) are in the North Canol, Kluane Lake and Southern Lakes regions. Two wildlife technicians worked in each area during the winters of 1982 and 1983. 1982 sampling was conducted in February-March. 1983 sampling began in October (1982) in the Kluane area and January (1983) in the others.

Population indices (tracks/km-days) were compared between study areas, and between vegetation types and other biophysical habitat components in order to evaluate a species preference or avoidance of a given area, or component. Temperature, snow depth and date measurements were grouped into arbitrary classes for analysis. The classes were chosen to evenly distribute sampling intensity (km-days) among the classes. Some vegetation classes were grouped to allow statistical analysis of the less abundant species.

Figure 6: Winter Track-Count Data Form

Yukon
Department of Renewable Resources

Observer	Transect No.	Day	Month	Year	Temperature	Snow Depth	Observations

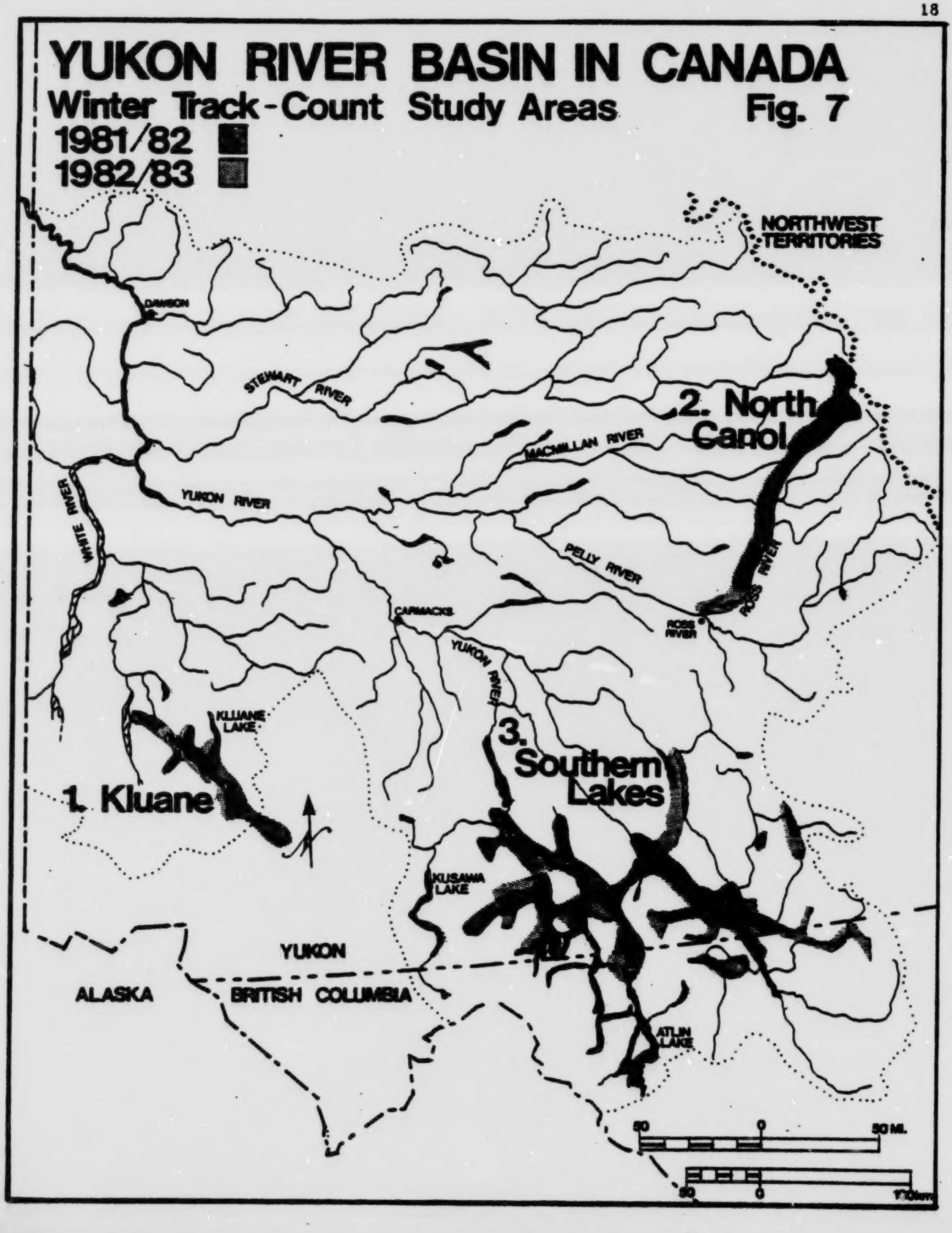
Days since last Snowfall	Transect Length	Km. Days	Vegetation Type	Canopy Cover	Terrain	Slope Aspect	NTS Map	U.T.M. GRID DESIGNATION Start	U.T.M. GRID DESIGNATION Finish

		Sightings			
Species	Tracks	Males	Females	Unknown	Total

LOCATION ______________________

VEGETATION ______________________

REMARKS ______________________



YUKON RIVER BASIN IN CANADA
Winter Track-Count Study Areas **Fig. 7**

1981/82 ■
1982/83 ▨

NORTHWEST TERRITORIES
DAWSON
STEWART RIVER
2. North Canol
MACMILLAN RIVER
YUKON RIVER
WHITE RIVER
PELLY RIVER
ROSS RIVER
ROSS RIVER
CARMACKS
YUKON RIVER
KLUANE LAKE
3. Southern Lakes
1. Kluane
KUSAWA LAKE
YUKON
ALASKA
BRITISH COLUMBIA
ATLIN LAKE
50
0
50 MI.
50
0
100km

Initially a chi-square goodness-of-fit test is applied to determine whether there is a significant difference between observed and expected track-counts in different categories. Expected values were calculated using proportions of km-days employed sampling individual or combined categories. Categories were usually combined so that: (1) there was at least one expected observation in each category, and (2) no more than 20% of all categories contained less than five expected observations. A chi-square was not calculated if these conditions could not be met.

If the chi-square value was significant (α =0.05) than the preference or avoidance of categories was tested by calculating confidence intervals for observations to estimate whether a specific observation occurred more or less frequently than expected. (technique of Neu et al 1974).

Fur Harvest Monitoring

Prior to 1951, fur harvest data was tabulated on a territory wide basis only and records were kept by Statistics Canada. Following the registrations of traplines in 1951, trapper declarations were implemented, and the fur harvest was monitored on an area specific basis. However, the accuracy of this data is questionable as it depended on the trapper's memory. Also, delays in filling out the declarations would result in a final report not being available untl 1 year after the trapping season was over.

In 1976, a computerized fur harvest inventory system was developed. This system did away with the trapper declarations and used fur export permits and fur trader records as source documents.

Fur harvest data is now available on an area, as well as, an individual, specific basis within one month of the end of the trapping season. British Columbia's fur harvest inventory is still tabulated by trapper declarations. However, a computerized system has been developed and should be implemented shortly.

Trapper Questionnaire

Questionnaires on animal population levels and trends have been mailed annually to all licenced Yukon trappers (and assistant trappers) since 1977. Trappers are asked to answer the questions based on their experience on their trapping areas over the past season. The questionnaire form used the first four years (1977 through 1980) questioned trappers on grouse and hare populations only. The form was revised in 1981 to cover 14 additional species of furbearers.

Data was compiled for traplines within the Yukon River Basin (see Appendix I, Map 1). Population indices were calculated from weighted averages as follows:

	Response	Weight
Population Level	Abundant	9
	Common	5
	Scarce	1
	Not Present	0
	Not Known	not included
Population Trend	Increased	5
	Remained Stable	0
	Decreased	5
	Not Present or Not Known	not included

RESULTS AND DISCUSSION

Trapper Questionnaire

The results of the trapper questionnaire analysis are presented in Tables 1 and 2. The response rate to the questionnaire was 10% to 20% in the early years and has increased to 40% in 1982 and 1983.

The most abundant species in the trappers judgements are presently wolves *Canis lupus*, squirrel *Tamiasciurus hudsonicus*, coyote *Canis latrans*, beaver, fox *Vulpes fulva* and lynx *Lynx canadensis*. Wolverine *Gulo luscus*, weasel *Mustela erminea*, marten *Martes americana* and mink *Mustela vison* are less common, while otter *Lutra canadensis*, grouse (mainly Spruce grouse, *Canachites canadensis*; Ruffed grouse, *Bonasa umbellus*; also Blue grouse, *Dendragapus obscurus*, Sharp-tailed grouse, *Pedioecetes phasianellus*), hare *Lepus americanus* and muskrat are "scarce".

Coyote, wolf and lynx are the only species believed to be increasing (in 1983). The rest are relatively stable, except muskrat, grouse and hare which are declining.

These results are believed to quite accurately reflect the real situation. The dramatic cycles of hare and grouse are very evident from the 6 years of data presented in Table 1. The hare population peak of 1980-81 corresponds with accurate scientific data obtained near the Arctic Institute of North America's Kluane Lake research

Table 1 Furbearer Population Level and Trend Indices for Yukon River Basin Study Area from Yukon Trapper Questionnaire*

Snowshoe Hare

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1977	3	18	21	-	-	42	3.3
1978	11	35	6	-	-	52	5.4
1979	20	24	6	-	-	50	6.1
1980	32	42	11	-	-	85	6.0
1981	62	23	7	1	0	93	7.3
1982	61	72	44	4	3	184	5.3
1983	12	46	135	19	8	220	2.2

Pop. Trend	Increased	Stable	Decreased	Not Present	Not Known	Total Responses	Index
1977	26	13	5	-	-	44	2.4
1978	39	10	2	-	-	51	3.6
1979	33	12	5	-	-	50	2.8
1980	52	29	3	-	-	84	2.9
1981	43	26	10	1	2	82	2.1
1982	29	46	67	3	12	157	-1.3
1983	6	22	132	10	25	195	-3.9

Table 1 Continued

Grouse

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1977	10	20	10	–	–	40	5.0
1978	5	32	15	–	–	52	4.2
1979	4	30	16	–	–	50	4.0
1980	8	44	29	–	–	81	4.0
1981	10	36	40	3	2	91	3.5
1982	12	59	87	10	13	181	2.9
1983	9	53	131	13	11	217	2.3

Pop. Trend	Increased	Stable	Decreased	Not Present	Not Known	Total Responses	Index
1977	29	11	4	–	–	44	2.8
1978	17	26	7	–	–	50	1.0
1979	10	22	16	–	–	48	–0.63
1980	17	47	17	–	–	81	0
1981	7	40	26	4	6	83	–1.3
1982	4	58	65	10	18	155	–2.4
1983	8	56	81	12	34	191	–2.5

Table 1 Continued

Beaver

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	5	45	28	6	8	92	3.5
1982	24	81	61	7	12	185	3.9
1983	25	99	55	12	22	213	4.1

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	11	49	8	7	6	81	0.22
1982	18	89	19	7	20	153	-0.040
1983	26	91	27	6	40	190	-0.035

Fox

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	17	37	29	2	4	89	4.3
1982	25	91	44	9	12	181	4.3
1983	19	116	57	8	18	218	4.0

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	24	38	2	5	10	79	1.7
1982	24	90	11	9	19	153	0.52
1983	23	104	24	8	36	195	-0.033

Table 1 Continued

Lynx

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	28	36	22	4	3	93	5.0
1982	50	83	40	7	5	185	5.0
1983	26	108	76	3	10	223	4.0

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	45	38	9	0	1	93	2.0
1982	80	81	20	1	3	185	1.7
1983	76	99	32	2	8	217	1.1

Marten

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	14	36	23	16	3	92	3.7
1982	32	56	46	31	18	183	3.7
1983	31	66	62	46	14	219	3.3

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	6	37	17	16	6	82	-0.92
1982	11	69	24	22	28	154	-0.63
1983	22	69	31	37	36	195	-0.37

Table 1 Continued

Mink

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	12	32	40	6	4	94	3.4
1982	13	69	78	9	15	184	3.2
1983	12	84	86	8	26	216	3.2

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	7	49	8	7	10	81	-0.078
1982	14	84	22	9	25	154	-0.33
1983	7	83	43	11	45	189	-1.4

Muskrat

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	8	20	40	10	13	91	3.1
1982	17	59	68	19	19	182	2.7
1983	5	44	108	29	28	214	2.0

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	9	29	15	12	14	79	-0.57
1982	10	70	30	16	27	153	-0.91
1983	9	58	49	22	49	187	-1.7

Table 1 Continued

Otter

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	2	14	49	15	10	90	1.7
1982	7	41	77	24	31	180	2.3
1983	8	47	102	21	32	210	2.3

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	1	41	6	9	20	77	-0.52
1982	8	68	19	16	39	150	-0.58
1983	14	69	26	20	56	185	-0.55

Squirrel

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	45	38	9	0	1	93	6.6
1982	80	81	20	1	3	185	6.3
1983	76	99	32	2	8	217	5.8

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	19	53	8	0	2	82	0.69
1982	36	86	19	2	12	155	0.60
1983	23	99	45	0	26	193	-0.66

Table 1 Continued

Weasel

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	6	37	38	3	5	89	3.3
1982	13	70	78	5	16	182	3.3
1983	12	96	78	7	21	214	3.5

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	5	51	7	4	13	80	-0.16
1982	12	82	27	6	26	153	-0.62
1983	13	95	37	4	39	188	-0.70

Wolverine

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	4	43	42	2	2	93	3.2
1982	17	80	68	10	10	185	3.5
1983	18	101	86	4	10	219	3.6

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	8	56	7	2	7	80	0.070
1982	15	92	22	8	21	158	-0.27
1983	28	105	28	3	30	194	0

Table 1 Continued

Wolf

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	35	40	17	1	1	94	5.7
1982	75	68	36	2	3	184	5.8
1983	81	95	35	0	8	219	5.9

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	34	31	10	0	7	82	1.6
1982	70	55	14	6	12	157	2.0
1983	72	83	16	1	28	200	1.0

Coyote

Pop. Level	Abundant	Common	Scarce	Not Present	Not Known	Total Responses	Index
1981	14	24	34	12	5	89	3.3
1982	38	55	51	28	9	181	3.9
1983	49	74	54	22	19	218	4.3

Pop. Trend	Increased	Remained Stable	Decreased	Not Present	Not Known	Total Responses	Index
1981	20	31	3	12	14	80	1.6
1982	41	59	9	23	21	153	1.5
1983	56	68	19	17	37	197	1.3

Table 1 Continued

---

*The year given refers to the year at the end of the trapping season, (i.e. 1977 = 1976/1977). The Yukon portion of the study area includes 278 trapping concessions, 7 radius trapping areas around communities (Tagish, Carcross, Whitehorse, Carmacks, Ross River, Mayo and Dawson) and 2 group trapping areas (Ross River and Kluane) (Map 1, Appendix 1, radius areas not shown).

The response rate has increased from 10% in 1977 to 40% in 1982 and 1983.

Index values were calculated from weighted averages as follows:

Population Level	Weight	Population Trend	Weight
Abundant	9	Increased	5
Common	5	Remained Stable	0
Scarce	1	Decreased	-5
Not Present	0	Not Present	not included
Not Known	not included	Not Known	not included

Table 2 Summary of 1983 Population Indices

Population Level

Abundant			9.0
	Wolf	5.9	
	Squirrel	5.8	
Common			5.0
	Coyote	4.3	
	Beaver	4.1	
	Fox, Lynx	4.0	
	Wolverine	3.6	
	Weasel	3.5	
	Marten	3.3	
	Mink	3.2	
	Grouse, Otter	2.3	
	Hare	2.2	
	Muskrat	2.0	
Scarce			1.0
Not Present			0

Population Trend

Increase			5.0
	Coyote	1.3	
	Lynx	1.1	
	Wolf	1.0	
Stable	Beaver, Fox, Wolverine		0
	Marten	- .37	
	Otter	- .55	
	Squirrel	- .66	
	Weasel	- .70	
	Mink	-1.4	
	Muskrat	-1.7	
	Grouse	-2.5	
	Hare	-3.9	
Decrease			-5.0

station by U.B.C. professor Dr. Charles Krebs (Scott Gilbert, research technician, pers. comm. 1983). The grouse population has shown a long stable "peak" between 1976-77 and 1979-80 with a decline in the growth rate of the population leading to population decline in 1980-81. (D. Mossop, Y.T.G. Ornithologist, pers. comm. 1983).

Grouse and hare are very significant members of the "food chain" in Yukon and several species, most notably lynx and coyote are expected to show a negative response after a lag period of 2-3 years. Most furbearer populations are evidently healthy or at least occur in "expected" densities. For example the less common or uncommon species have limited habitats in the Yukon River Basin, and although they may be abundant within their preferred habitat types, their population densities over most registered trapping areas would naturally be perceived as low. Muskrat habitat is limited in the River Basin, although the populations within these areas appear (to the trappers) to be declining. This is the only "problem" identified by the questionnaire and can only be attributed to a natural population fluctuation, as no other potential causes have been identified.

The results of the questionnaire will be discussed in conjunction with the results of the inventory studies given below by species. The fur harvest data, presented in the section on "Trapping", is also cited where applicable.

POPULATIONS, TRENDS, HABITATS

Beaver (1982 Yukon River Basin Harvest - 482)

The density of active beaver colonies on stream reaches was plotted on Map 2 (Appendix I). Densities in the boreal forest region throughout northwestern North America average about 3 km/active colony with densities as high as 1 km/active colony exceptional. An arbitrary rating system was devised as follows:

Class	Description	km/Active Colony
1	Excellent	2.0 -
2	Good	2.1 to 3.0
3	Fair	3.1 to 5.0
4	Poor	5.1 +

The rating system has been applied to Map 2, showing colony site density. The "excellent" and "good" stream reaches are also listed in Table 3, along with a comparison of reaches surveyed both in 1982 and 1983.

The beaver is distributed throughout the river basin on smaller streams, including the headwaters of rivers, up to elevations of 1500 m., on low gradient rivers and on larger rivers with backwaters, oxbows and small tributaries. The principal food species is willow (Salix spp.) with balsam poplar (Populus balsamifera) and aspen (P. tremuloides) utilized where they are found on lowland alluvial and other well drained sites. Other food species may include white birch

Table 3 1982-83 Beaver Colony Densities

HABITAT Rating	Drainage	River	1982 Density (1983)*
Excellent (2.0 or less km/active colony)			
	Teslin	Hayes	2.0
	MacMillan	Tributary	1.7
	Yukon main-stem	Snafu Ck	1.8
		Nordenskiold below Klusha Ck	2.0 (7.5)
		Klusha Ck	2.0 (1.8)
Good (2.1 to 3.0 km/active colony)			
	Teslin	Squanga Ck	2.8
	Pelly	Big Timber Ck	2.1
		Upper Ross	2.8
		Lakes south of Prevost R.	2.7
		Lakes west of Ross R.	3.0
	MacMillan	S. MacMillan-Hess pass	2.8
		Tay R. tributary	2.5
		Earn	2.5
	Yukon main-stem	Mendenhall	2.2
		Little River	2.2
		Tarfu Ck	2.5
1982-83 Comparison*			
	Yukon main-stem	Yukon(Laberge to Marsh Lk)	5.0 (5.8)
		McClintock-Squanga headwaters	4.5 (6.0)
		Takhini	4.3 (4.7)
		Klusha	2.0 (1.8)
		Nordenskiold (below Klusha Ck)	2.0 (7.5)
		Yukon(Little Salmon to Carmacks)	5.9 (6.7)
		Big Salmon (lower)	35.0 (5.0)
		Big Salmon (mid)	3.8 (30.4)
		Big Salmon (upper)	3.5 (4.4)
	Teslin	Nisutlin	7.5 (9.6)
		Rose	48.0 (16.0)
		Lapie-Rose headwaters	4.1 (5.5)

*1983 density in parentheses

(Betula papyrifera), shrub birch (B. glandulosa), submergent aquatic plants and herbaceous terrestrial species. The quality of beaver habitat in the study area is generally highest in lower elevation, low gradient streams and on smaller lakes or lakes with irregular shorelines. Aspen, the preferred food is most abundant in the extensive lowlands within the Takhini burn area between Carmacks and Whitehorse, and in the Teslin burn west of Teslin Lake. The highest (known) beaver densities in the study area are found here (Table 3:Hayes, Snafu, Nordenskiold, Klusha, Squanga, Mendenhall, Little River, Tarfu). The high densities noted on the other reaches given in Table 3 are due to an extremely productive growth of willows. Willow productivity and hence beaver productivity is expected to be greater at lower elevations. The subalpine areas (such as Table 3:MacMillan tributary) thus represent marginal habitat. The apparent anomolies will be explained later. The Nisutlin River is unique in the study area for it's extensive shoreline coverage of balsam poplar which support beaver where physical conditions permit. The capability of the larger rivers may be impaired by flowing ice in the spring and by drastic water level depressions over winter. The mortality of kits and yearlings during spring break-up may be as high as 95% (M. Novak, Ontario Fur Management Biologist, pers. comm.).

The rivers re-surveyed in 1983 show a slight decline in the numbers of active beaver colonies (Table 3). Only one stream, Klusha Creek, showed an increase. Two corollaries may be drawn for this observation: 1) The beaver population in the study area is near its carrying capacity and is no longer expanding, and 2) The cutting-abandonment cycle occurs throughout the study area.

With the ability of colonies to relocate and the subsequent territoriality of established colonies, the overall population will be quite stable. The recolonization of vacant habitat may be hindered to a degree by increased predation on dispersing juveniles (2 and 3 year olds which are leaving their parent colonies) and relocating adults during the period when other prey (snowshoe hare, grouse, and ptarmigan) are scarce.

The beaver harvest is probably well below maximum sustained yield level. The low pelt prices in recent years have resulted in a reduced trapper effort. Trappers view their beaver populations as abundant and stable (questionnaire analysis).

When a beaver colony vacates a site or is trapped, it leaves an "inactive" site, which is sometimes recorded during the surveys, but is generally very difficult to spot from the air. Depending on the type of structure present (bank den, dam, lodge) and the time since last occupancy, inactive sites are usually missed during aerial surveys. These are best enumerated by careful survey of the river by boat. The statistic of colony site occupancy rate (active colonies/active + inactive sites) is rarely reported although it is of interest as it relates to the carrying capacity of the habitat, current population levels relative to the carrying capacity and habitat quality. For that reason, total colony site inventory was carried out on a number of streams.

On a 96 km section of the Wolf River, 23 out of 45 colony sites identified by canoe in July 1982, were active in September 1982. The occupancy rate is therefore (23/45) x 100% = 51.1%. The occupancy rate on a 127 km section of the Nisutlin River surveyed by boat in September-October 1981 was (22/55) x 100% = 40%. In the Lapie-Rose system a similar survey in the fall of 1981 resulted in an occupany rate of (15/52) x 100% = 28.8%.

The occupancy rate of beaver colony sites is generally 40% on lakes and 75% on streams (Slough and Sadleir 1977, Dennington and Johnson 1974). The low occupancy rate in the study area probably indicates a lower habitat carrying capacity. Beaver trapping has been minimal in the past number of years and should not have affected the occupancy rate.

Colonies are regularly abandoning sites and re-occupying other sites as food supplies become depleted. The number of active colonies in the Lapie-Rose complex (33 km between Upper Sheep Creek and Porcupine Creek) has varied between 7 (1977), 4 (1978), 15 (1981) and 8 (1982). The 7 sites occupied in 1977 were all abandoned with 4 new sites adopted in 1978. Mobility between colony sites is greater in poor habitat and in fact can be used as an indicator of habitat quality. Similarly, beaver remain in the colony longer in better quality habitat (longer cutting-abandonment rotation) and resulting colony sizes are larger. Research is currently being conducted to examine the sizes of beaver colonies in relation to habitat type. Initial results indicate a larger mean colony size, with juveniles remaining longer (3 years vs. 2 or 1) in lower elevation riparian areas.

Muskrat (1982 Yukon River Basin Harvest - 768)

The observed muskrat pushup density was plotted on study area maps (Appendix I, Map 3-1982, Map 4-1983) using three arbitrary categories:

Low: $<$ 5 pushups/km^2 on isolated lakes or ponds
Moderate: $<$ 5 pushups/km^2 on continuous wetlands
High: $\geq$ 5 pushups/km^2

Muskrats are distributed throughout the River Basin in rivers, streams, marshes, and shallow lakes and potholes. Optimal environmental requirements include an abundant supply of emergent and submergent plants, water bodies with good shoreline or bank development and depths below normal ice-formation levels (1m). The majority of muskrat habitat in the study area is poor. This is indicated by several factors:

1. The small body size of the northwestern muskrat (*Ondatra zibethicus spatulatus*) relative to other races, possibly due to limited availability and poor quality of food supplies.
2. The occupancy of bank burrows, rather than houses which are used in more temperate regions, due to a lack of emergent vegetation needed for construction materials, and great ice thickness.
3. The extensive use of "pushups", used to extend their foraging range.

The high density areas are listed in Tables 4 (1982) and 5 (1983).

Table 4 1982 Muskrat Pushup Survey Results

Unit	Description	Transect Length	Transect Area (km^2)	No. Pushups	Pushup Density (per km^2)
1	Pickhandle Lakes	15	30	605	20.2
2	Kloo Lake - Jarvis River*	17.5	35	319	9.1
3	Hutshi Lakes (north)	2.5	5	140	28.0
4	Taye Lake	7.5	15	129	8.6
5	Yukon River marsh	12	24	222	9.3
6	Hyland Lake (Teslin R.-Kedahda R., B.C.)	15	30	221	7.4
7	Nisutlin 1	2.5	5	45	9.0
8	Nisutlin 2	2.5	5	60	12.0
	TOTAL	74.5	149	1,741	11.7

*Not in Yukon River Basin

Table 5 1983 Muskrat Pushup Survey Results

Unit	Description	Transect Length	Transect Area (km^2)	No. Pushups	Pushup Density (per km^2)
1	Scottie Creek	42	84	657	7.8
2	Scottie Creek (south)	8	16	90	5.6
3	Pickhandle Lakes	15	30	352	11.7
4	Nisling River	2.5	5	96	19.2
5	Kloo Lake-Jarvis R.*	17.5	35	264	7.5
6	Hutshi Lakes (north)	2.5	5	143	28.6
7	Taye Lake	7.5	15	80	5.3
8	Mendenhall River	5	10	103	10.3
9	Nordenskiold River	5	10	102	10.2
10	Ess Lake	5	10	105	10.5
11	Mist Lake	4.5	9.0	49	5.4
12	McQuesten Lake	20	40	223	5.6
13	Nisutlin 1	2.5	5	78	15.6
14	Nisutlin 2	2.5	5	42	8.4
	TOTAL	139.5	279	2,384	8.5

*Not in Yukon River Basin

Although scattered, these areas generally occur below 1000 m. a.s.l. The aerial extent of these higher quality habitats was about 150 square km in 1982 and 280 square km in 1983. Survey techniques and environmental conditions no doubt inject considerable variability into the counts, therefore we are reluctant to comment on trends in pushup numbers. Additional unknowns enter the picture when converting from pushup to actual muskrat densities. Pushup densities of 20/km^2 have been reported for Old Crow Flats (Slough 1982) and up to 40/km^2 for the MacKenzie Delta (Stevens 1955). These areas must be considered poor, although, extensive muskrat habitat by North American standards. The limited availability of muskrat habitat is reflected by both the trapper questionnaire and fur harvest. These data also point out that populations may be declining perhaps within a long-term population cycle.

The Department is initiating studies of the muskrat on Old Crow Flats in 1984 to substantiate the inventory technique and to learn more of the ecology of the muskrat as it relates to the optimization of harvesting methods.

Winter Track-Counts

The track-count transects are summarized in Table 6. The total distance sampled was 856.1 km (n=365) in 1982 (Feb.-April) and 1396.0 km (n=557) in 1983 (Oct 82-April 83). This represents 2204.5 km-days in 1982 and 8043.5 km-days in 1983.*

---

*1 km-day=1 km transect distance/1 day since last snowfall.

Table 6 Summary of Winter Track-Counts

		STUDY AREA			
Year		Kluane	Southern Lakes	North Canol	Total
	No. Transects	135	120	110	365
1982	Days since last snow	373.3(2.77 ± 0.23)	237.0(1.98 ± 0.18)	424.0(3.85 ± 0.43)	1034.3(2.83 ± 0.17
	Length (km)	239.2(1.77 ± 0.13)	384.7(3.20 ± 0.50)	232.2(2.11 ± 0.14)	856.1(2.35 ± 0.09
	Km - days	606.9(4.50 ± 0.41)	741.1(6.18 ± 0.73)	856.5(7.79 ± 1.04)	2204.5(6.04 ± 0.43
	No. Transects	198	190	169	557
1983	Days since last snow	1318.0(6.66 ± 0.42)	1059.0(5.57 ± 0.31)	701.5(4.15 ± 0.32)	3078.5(5.53 ± 0.21
	Length (km)	490.2(2.48 ± 0.13)	545.3(2.87 ± 0.15)	360.5(2.13 ± 0.15)	1396.0(2.51 ± 0.08
	Km - days	3517.8(17.8 ± 2.30)	3104.7(16.3 ± 1.47)	1421.0(8.41 ± 1.02)	8043.5(14.4 ± 1.02

* mean and standard error in parenthesis ($\bar{X} \pm SE$)

The relative abundance indices (tracks/km-day) of furbearers measured annually in each study area are given in Table 7, along with utilization preferences of the study areas. An example of the utilization-availability analysis is given in Table 8.

Ten species of furbearing animals were encountered on the track-counts (weasel, mink, marten, wolverine, otter, red fox, coyote, wolf, lynx and red squirrel) (Table 7). During the winter when ice covers lakes and streams, beaver and muskrat are active only under the ice, or when extreme conditions force them to seek food on land (Note-this option is generally not open to them). They will also go onto the ice in spring when air temperatures are moderate and fresh food is available. A single muskrat track was observed on the Yukon River in spring 1982. Otters, and possibly mink, also spend much of their active time under ice or, at least, in the air space between the ice and water or between shore ice and the shore. Thus the observation of otter tracks may be more closely linked with the occurrence of open water which gives them access to the ice surface, rather than abundance per se. Fisher Martes penannti are known to occur in the River Basin only rarely from reports on fur returns from B.C. and from incidental sightings in Yukon. None were observed during the surveys. Arctic fox Alopex lagopus does not occur in the study area.

The most abundant tracks recorded during the surveys were those of snowshoe hare, red squirrel, and ptarmigan; mainly willow ptarmigan Lagopus lagopus, but also rock ptarmigan Lagopus mutus and white-tailed

Table 7 Relative Abundance Indices of Furbearers and Utilization-Availability of the Study Areas

	1982														1983													
	KLUANE				SOUTHERN LAKES				NORTH CANOL				TOTAL			KLUANE				SOUTHERN LAKES				NORTH CANOL				TOTAL		
Species	Tracks	Tracks/ Km-day	Util* A	B	Tracks	Tracks/ Km-day	Util* A	B	Tracks	Tracks/ Km-day	Util* A	B	Tracks	Tracks/ Km-day	B	Tracks	Tracks/ Km-day	Util* A	B	Tracks	Tracks/ km-day	Util* A	B	Tracks	Tracks/ Km-day	Util* A	B	Tracks	Tracks/ Km-day	B
Weasel	17	.028	-	ns	58	.078	=	ns	103	.120	+	+	178	.081	+	154	.044	-	ns	195	.063	=	ns	96	.068	=	-	445	.055	-
Mink	1	.002	-		33	.045	+	+	14	.016	=	+	48	.022	+	8	.002	-		48	.015	+	-	1	.001	-	-	57	.007	-
Marten	0	0	-		51	.069	-	ns	262	.306	=	+	313	.142	+	8	.002	-		162	.052	=	ns	259	.182	+	-	429	.053	-
Wolverine	5	.008	-	-	3	.004	-	-	37	.043	+	+	45	.020	-	118	.034	ns	+	102	.033	ns	+	31	.022	ns	-	251	.031	+
Otter	0	0			3	.004			7	.008			10	.005		0	0			7	.002			0	0			7	.001	
Red Fox	72	.119	+	+	50	.067	=	+	37	.043	-	=	159	.072	+	41	.012	-	-	79	.025	=	-	85	.060	+	=	205	.025	-
Coyote	566	.933	+	+	107	.144	-	+	1	.001	-		674	.306	+	608	.173	+	-	80	.026	-	-	0	0	-		688	.086	-
Wolf	29	.048	=	+	107	.144	+	+	6	.007	-		142	.064	+	35	.010	-	-	188	.061	+	-	5	.004	-		228	.028	-
Lynx	63	.104	+	+	73	.099	+	=	1	.001	-	-	137	.062	-	191	.054	-	-	380	.122	+	=	51	.036	-	+	622	.077	+
Red Squirrel	614	1.012	+	+	1018	1.374	+	+	99	.116	-	+	1731	.785	ns	2960	.841	+	-	3501	1.128	+	-	38	.027	-	-	6499	.808	ns
Snowshoe Hare	17450	28.753	+	+	12979	17.513	+	+	1572	1.835	-	-	32001	14.516	+	8465	2.406	-	-	10342	3.331	+	-	3817	2.686	-	+	22624	2.813	-
Porcupine	2	.003			1	.001			0	0			3	.001	-	29	.008	=		20	.006	=		0	0	-		49	.006	+
Mouse	33	.054	-	-	148	.200	+	+	124	.145	=	+	305	.138	ns	695	.198	+	+	428	.138	-	-	102	.072	-	-	1225	.152	ns
Grouse	2	.003			8	.011		-	2	.002			12	.005	-	18	.005	-		119	.038	+	+	0	0	-		137	.017	+
Ptarmigan	0	0	-	-	55	.074	-	=	1203	1.405	+	+	1258	.571	+	1556	.442	+	+	164	.053	-	=	657	.462	+	-	2377	.296	-
Moose	10	.016	-	-	62	.084	+	-	46	.054	=	-	118	.054	-	200	.057	-	+	550	.177	+		173	.122	=	+	923	.115	+
Caribou	0	0			0	0		-	14	.016		+	14	.006	-	4	.001	-		156	.050	+	+	0	0	-	-	160	.020	+

*Utilization:		
	blank	X^2 not calculated
	ns	X^2 not significant (α =0.05)
	-	avoided
	+	preferred
	=	utilized proportional to occurrence

A=Comparison between study areas (same year)

B=Comparison between 1982/83 (same study area)

Table 8 Example of Utilization - Availability Analysis

Area=Kluane Year=1983 Species=Coyote

Vegetation Type	Km-days	Proportion Km-days	Tracks Observed	Tracks Expected	Proportion Observed	Lower Limit	Upper Limit	Utilization
1 White Spruce	900.5	0.263	169	160.0	0.278	0.229	0.327	=
9,11 Aspen or White spruce-aspen	134.8	0.039	35	23.9	0.058	0.032	0.083	=
10,12 Balsam poplar or White spruce-balsam poplar	140.3	0.041	36	24.9	0.059	0.033	0.085	=
15 Willow	246.5	0.072	84	43.8	0.138	0.101	0.176	+
16 Shrub Birch	153.4	0.045	40	27.3	0.066	0.039	0.093	=
17 Herbaceous	77.3	0.023	17	13.7	0.028	0.010	0.046	=
18,19 No cover-lake ice stream bed	1769.8	0.517	227	314.4	0.373	0.321	0.426	-

Utilization: $X^2 = 78.496$ d.f. = 6 Tabular X^2 ($\alpha = 0.05$) = 12.592

X^2 is significant. Therefore confidence limits were calculated on proportion of tracks observed in each category. This is compared with proportion of km-days in each category (after Neu et al 1974).

- avoided (utilized less than expected)
= utilized proportional to occurrence
+ preferred (utilized more than expected).

ptarmigan Lagopus leucurus (>.5 tracks/km-day) (Table 7). Moderately abundant species (from 0.1 to 0.5 tracks/km- day) included weasel, marten, red fox, wolf, coyote, lynx and mouse species. Mink, otter and wolverine, and two important prey species, porcupine and grouse were uncommon. The track densities of moose and caribou are presented in the tables of results for interest's sake, although a projected relationship with furbearers is not discussed.

Penner (1979) summarizes track-count data from B.C., Alberta and N.W.T. in "Furbearer Studies in the Liard River Valley, British Columbia". The track densities of all species with the exception of weasel, mink and otter compare favourably with those obtained form other areas.

The results of the track-counts and preference-avoidance tests will now be summarized by species. The analytical tables will not be individually referenced (Tables 9 through 15). Data from the questionnaire and fur harvest analyses are referred to.

Weasel (1982 River Basin Harvest - 173)

Weasel were most commonly recorded from the North Canol area in both field seasons, although the number was significantly lower in 1983. There were fewer recorded in Kluane than expected. Weasels were ubiquitous to all terrain types except standing water bodies (Southern Lakes 1983). They avoided low snow depths in Southern Lakes (1983) but preferred the lowest snow depth class as well as the deepest

Table 9 Canopy Cover Utilization

	1982					1983										
	Kluane		Southern Lakes			Kluane				Southern Lakes				North Canol		
Species	1	2	1	2	3	1	2	3	4	1	2	3	4	1	2	3 & 4
Marten														=	+	=
Wolverine						-	+	=	-							
Red Fox	-	+														
Coyote	+	-	---n.s.--			-	=	=	+							
Wolf			=	+	-											
Lynx										=	-	+	+			
Red Squirrel	-	+	-	+	=	-	+	+	-	-	+	+	=			
Snowshoe Hare	+	-	-	+	+	-	+	+	+	+	=	+	+	-	+	+
Mouse			-	+	=	-	+	+	+	=	+	=	+			
Ptarmigan						-	+	+	-					=	-	+
Moose										=	-	+	+			
Caribou										=	=	=	-			

Canopy Cover 1. 0 - 25% 2. 26 - 50% 3. 51 - 75% 4. 76 - 100%

Table 10 Terrain Utilization

	1982																1983																					
	Kluane					Southern Lakes						North Canol					Kluane								Southern Lakes							North Canol						
Species	1	2	4	6	7	1	2	4	6	7	8	1	2	6	7	8	1	2	3	4	5	6	7	8	1	2/3	4	5	6	7	8/9	1	2/3	4	5	6	7	8
Weasel																									-	=	=	=	=	=	=							
Marten												-	-	=	+	=																-	+	-	=	-	+	-
Coyote	=	=	+	-	=	-----n.s.-----											-	=	=	=	=	+	-	+														
Wolf						-	=	=	=	=	+														=	=	=	-	=	=	=							
Lynx																									-	=	-	+	=	+	=							
Red Squirrel	-	-	-	+	-	-	-	-	+	+	=						-	-	-	-	+	+	+	-	-	-	+	+	=	+	=							
Snowshoe Hare	-	-	-	+	+	-	+	-	-	+	+	-	+	-	-	+	-	-	-	-	+	+	+	+	-	-	-	+	+	+	+	-	-	-	+	-	-	+
Mouse																	-	-	-	-	+	+	+	-	-	-	=	+	=	=	-							
Ptarmigan												-	-	-	+	-	-	-	-	-	+	+	+	+								-	-	+	-	-	-	+
Moose																	-	=	=	-	+	+	=	+	-	=	=	+	=	=	=	+	+	=	=	=	-	=

Terrain

1. Standing water body
2. Streambed
3. Riverbed
4. Shoreline
5. Riparian/valley bottom
6. 0 - 10% slope (flat to undulating)
7. 11 - 30% slope (gentle)
8. 31 - 60% slope (moderate)
9. 60+% slope (steep)

Table 11 Slope Aspect Utilization

	1982																1983																	
	Kluane					Southern Lakes						North Canol					Kluane						Southern Lakes						North Canol					
Species	1	2	3	4	6	1	2	3	4	5	6	1	2	3	4	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Weasel												=	=	=	-	=	=	=	=	=	=	=	=	=	=	+	-	=						
Marten												=	=	+	-	-							=	+	=	=	=	-						
Wolverine																	=	=	+	=	+	-	=	+	=	=	=	=						
Red Fox																							=	=	=	-	=	=						
Coyote	=	=	+	-	=												=	=	=	=	-	=	=	=	-	=	-	=						
Wolf																							-	=	-	=	=	=						
Lynx																	+	=	+	+	+	-	-	+	=	=	=	=						
Red Squirrel	+	+	-	-	-	=	+	-	+	=	=	=	-	+	-	-	-	-	+	+	=	-	-	-	-	+	=	-						
Snowshoe Hare	-	+	+	+	-	-	-	-	=	+	-	=	=	+	-	-	+	-	+	=	=	-	-	+	-	+	-	-	-	+	-	+	-	+
Mouse												=	=	-	-	+	=	+	+	+	=	-	-	-	=	+	+	-						
Grouse																	+	+	+	-	+	-	=	=	-	+	=	=						
Ptarmigan												-	=	-	-	+							+	-	-	=	=	=	-	-	+	-	+	=
Moose																	+	-	+	=	+	-	=	+	-	-	-	+						
Caribou																							-	=	=	=	=	=						

Slope Aspect 1. North facing 2. East facing 3. South facing 4. West facing 5. Varied 6. Flat

Table 12 Snow Depth Utilization

	1982																1983																		
	Kluane						Southern Lakes				North Canol						Kluane							Southern Lakes						North Canol					
Species	1	2	3	4	5	6	1	2	3	4/5	1	2/3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	1/2	3	4	5	6	7
Weasel																	+	=	-	-	=	+	=												
Mink											-	-	=	+	=	-																			
Marten																								-	=	-	=	+	+	-	+	-	=	=	-
Wolverine																	=	-	-	-	+	+	=	-	=	-	=	+	+						
Coyote	=	-	=	-	-	+	---n.s.--										+	=	=	=	-	-	=												
Wolf							-	=	=	+														=	=	-	+	-	-						
Lynx							-	=	=	+							=	-	-	-	+	=	=	-	+	-	=	+	=						
Red Squirrel	-	+	-	+	=	-	-	-	+	+							+	-	-	-	+	+	-												
Snowshoe Hare	-	+	-	-	+	-	-	+	+	+	+	-	+	=	-	-	+	-	-	-	+	=	-							-	+	-	+	-	-
Mouse							-	=	+	=							+	-	-	-	+	+	+												
Grouse																																			
Ptarmigan											-	-	-	-	+	=	-	-	-	=	+	+	=							+	-	-	+	+	-
Moose																	=	=	-	+	=	=	=							=	=	-	+	=	-
Caribou																																			

Snow Depth (cm) 1. 1-29 2. 30-39 3. 40-49 4. 50-59 5. 60-79 6. 80-99 7. 100+

Table 13 Activity at Ambient Temperatures

	1982														1983											
	Kluane				Southern Lakes					North Canol					Kluane				Southern Lakes					North Canol		
Species	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1/2	3	4	5	1	2	3	4	5	3	4	5
Weasel										=	=	=	-	+	=	-	+	+	-	+	=	+	=	=	+	=
Mink					-	+	=	=	-										=	-	=	=	=			
Marten					-	-	=	=	=	-	-	+	-	=					-	=	+	+	=	---n.s.--		
Wolverine										-	-	-	+	=	=	=	=	=	=	-	=	+	-	-	+	=
Red Fox					-----n.s.-----					-----n.s.-----									=	=	=	=	=	=	=	-
Coyote	=	+	-	-	=	=	=	=	-						=	-	+	=	-	=	=	+	-			
Wolf					=	+	-	=	-										-	-	=	+	=			
Lynx					=	=	=	+	-						=	-	+	=	-	-	+	+	-	=	=	=
Red Squirrel	+	+	-	-	+	=	+	-	-	=	=	+	-	=	+	-	=	+	+	+	=	-	-	-	+	-
Snowshoe Hare	-	-	+	+	+	-	+	+	-	-	-	+	-	+	+	-	+	+	-	-	+	+	+	-	+	+
Mouse					=	=	=	=	-	=	-	-	-	+	=	-	+	=	-	=	+	=	-	=	+	-
Grouse																			=	=	=	=	-			
Ptarmigan					-	+	-	-	-	-	=	-	+	-	-	-	+	+	+	-	-	-	-	-	+	-
Moose					=	=	=	=	-	-	-	-	+	+	=	-	+	=	-	=	=	+	+	-	+	=
Caribou																			-	=	+	=	+			

Temperature (°C) 1. 0 thru 11 2. -5 thru -1 3. -10 thru -6 4. -20 thru -11 5. -40 thru -21

Table 14 Temporal Activity Patterns

	1982													1983															
	Kluane					Southern Lakes				North Canol				Kluane						Southern Lakes					North Canol			
Species	4	5	6	7*	8	4	5	6	7	4	5	6	7	1/2	3	4	5	6	7/8	2/3	4	5	6	7	3	4	5	6
Weasel						=	-	=	=	-	+	=	=	+	=	=	=	=	-	=	+	+	-	-	=	=	-	+
Mink						=	=	+	-																			
Marten						=	=	=	-	=	=	+	-							=	+	=	-	-	=	+	-	=
Wolverine														=	=	=	+	-	-	-	+	-	=	-				
Red Fox						-	-	+	=											+	=	=	=	=	=	+	-	-
Coyote	=	=	-	+	=	=	-	+	=					+	=	=	=	=	-	=	+	=	=	-				
Wolf						-	=	+	=											+	+	-	=	-				
Lynx	=	+	=	=		=	-	=	=					+	=	=	+	-	-	+	+	=	-	-				
Red Squirrel	+	-	-	+	=	-	-	=	+	-	-	+	=	+	-	-	=	=	-	-	-	+	+	+				
Snowshoe Hare	+	+	+	-	-	+	-	=	=	+	+	-	-	+	-	+	+	-	-	+	+	+	-	-	-	+	-	-
Mouse						=	-	=	+	=	+	-	-	+	=	+	+	=	-	-	-	+	=	=	=	+	-	-
Grouse																				-	=	=	=	+				
Ptarmigan						-	=	+	-	-	-	+	=	+	-	+	+	-	-	-	=	=	-	+	+	-	-	+
Moose						-	-	+	=	+	+	-	-	+	+	-	=	=	-	+	+	=	-	-	+	+	-	-
Caribou																				=	=	=	=	=				

* 7 and 8 combined for lynx only

Date
1=Oct 1 thru Dec 31
2=Jan 1 - 15
3=Jan 16-31
4=Feb 1 -15
5=Feb 16-28
6=March 1 -15
7=March 16-31
8=April 1 -15

Table 15 Vegetation Type Utilisation

	1982																											
	Kluane										Southern Lakes												North Canol					
Species	1	3	10	11	12	15	16	17	18	19	1	2	3	4	9	11	10 + 12	13	14	15	16	18 + 19	3	5 to 7	1,11 + 13,14	15	16	18 + 19
Weasel																												
Marten																							=	+	=	-	=	-
Red Fox											=	=	=	=	=	=	=	-	=	-	=	-						
Coyote	=	-	=	-	=	-	+	=	=	=	=	=	=	=	=	=	=	=	=	=	+	=						
Wolf											+	=	=	=	-	-	=	=	=	-	+	-						
Lynx																												
Red Squirrel	+	-	-	-	+	=	-	-	-	-	-	+	+	-	-	+	+	+	-	-	=	-						
Snowshoe Hare	+	+	+	-	-	+	-	+	-	-	-	+	=	-	-	+	+	+	+	-	+	-	=	+	+	-	-	-
Mouse											=	=	=	=	-	+	=	+	=	=	-	-						
Ptarmigan																							-	-	=	+	+	-
Moose																												

	1983																										
	Kluane							Southern Lakes												North Canol							
Species	1	9 + 11	10 + 12	15	16	17	18 + 19	1	2	3	4	5	6	8	10	11	13 + 14	15 + 16	18	1	3	5 to 7	9 + 11,12	13 + 14	15	16	18 + 19
Weasel	+	+	=	=	=	-	-	+	-	=	=	=	+	=	=	=	=	=	-								
Marten																				=	=	=	-	-	=	-	-
Red Fox																											
Coyote	=	=	=	+	=	=	-																				
Wolf								+	=	=	=	-	=	-	-	-	=	=	=								
Lynx	+	+	=	-	=	-	-	=	=	+	+	-	-	=	=	-	-	=	-								
Red Squirrel	+	=	+	-	-	-	-	+	+	-	=	-	-	=	=	=	+	-	-								
Snowshoe Hare	+	+	+	-	-	-	-	+	-	+	+	-	+	=	=	-	+	-	-	+	-	-	+	+	-	-	-
Mouse	+	+	+	-	=	-	-	=	=	=	+	-	=	=	=	=	=	=	-								
Ptarmigan	=	-	+	+	=	-	-													=	-	-	-	+	=	+	=
Moose	=	=	=	+	+	-	-	=	=	=	+	-	+	-	=	-	-	=	-								

Vegetation Types

1. White spruce
2. White spruce - Lodgepole pine
3. Black spruce (white spruce) (lodgepole pine)
4. Lodgepole pine
5. Alpine fir
6. Alpine fir - white spruce
7. Alpine fir - black spruce (white spruce)
8. Alpine fir - lodgepole pine (white spruce)
9. Trembling aspen
10. Balsam poplar
11. White spruce - trembling aspen (lodgepole pine)
12. White spruce - balsam poplar
13. Black spruce - trembling aspen (white spruce)
14. Lodgepole pine - trembling aspen (white spruce)
15. Willow
16. Shrub birch
17. Herbaceous
18. No cover - lake ice
19. No cover - river or creek bed

classes in Kluane (1983). Prey species (mice) showed similar preferences. Weasels occurred in a wide range of vegetation types exclusive of areas where there were no shrubs or trees. Home ranges are generally less than 5 km^2. The populations are stable, low, and harvested well below their potential.

Mink (1982 River Basin Harvest - 459)

Mink were most common in Southern Lakes and least in Kluane. Track densities declined in 1983. Mink were generally associated with riparian areas and exhibited low densities. Optimal mink habitat will be found in extensive productive wetlands. The higher capability beaver and muskrat habitats shown on Maps 2,3 and 4 (Appendix I) should correlate closely with centres of mink abundance. Mink home ranges overlap, and average 10 km^2 for females and 15 km^2 for males. The relatively low population of mink is stable and also underharvested.

Marten (1982 River Basin Harvest - 2323)

Marten were most common in the North Canol area and were virtually absent from the Kluane area. The fur harvest and trapper questionnaire data have in fact identified a large area within the southern River Basin, extending from Kluane Lake to Teslin Lake, where marten are rare as a result of overharvesting and fires (in 1958) and subsequent trapping pressure which has prevented recolonization.

Track numbers declined in 1983. Marten avoided water bodies including streambeds (North Canol-1982). They were present in all treed areas of the North Canol, preferring climax coniferous forests with moderate cover. The marten, is a primary economic species of the Yukon River Basin. The population is suspected to be approaching the upper limit of a sustainable yield since this species is relatively easy to trap and prices are attractive. Marten home ranges have been calculated at 4.7 km^2 for females and 6.2 km^2 for males in the Evelyn Creek study area (Nisutlin drainage) (Archibald and Jessup 1983).

Wolverine (1982 River Basin Harvest - 85)

Wolverine were most abundant in the North Canol in 1982 and were equal in all areas in 1983, following increases in Kluane and Southern Lakes. Other than lynx, wolverine were the only furbearer to show an increase in 1983. Since prey is scarce, the increased density is seen as a shift in habitat and/or activity patterns. The results of the trapper questionnaire and fur harvest analyses do not support the interpretation of an expanding population. The wolverine preferred moderate canopy cover. Since wolverine home ranges are relatively large (100 to 1000 km^2) they can be expected to encompass a wide range of vegetation and physical habitat components.

Otter (1982 River Basin Harvest - 14)

Otter track densities were too low for statistical analysis. They are associated with larger water bodies especially where there is open water in winter, for example at rapids, airholes and even muskrat pushups and beaver lodges. Otter also utilize the space between solid ice cover and water for breathing. Their main prey is fish, therefore, they can be expected to closely follow the distribution of salmon, grayling, and other fish in the Yukon drainage. An otters home range varies considerably throughout the year and may reach 180 km^2 in fall or spring. Because of their habits, otter track densities are an underestimate of population density. The otter harvest is largely incidental to beaver trapping and is again not dependent on populations. Trappers believe otter to be relatively uncommon.

Red Fox (1982 River Basin Harvest - 541)

Red fox were most abundant in Kluane in 1982 and North Canol in 1983, showing an overall decline in 1983. The red fox preferred moderate canopy cover (Kluane 1982) in forested areas. In the North Canol area they were common in the high alpine areas where they were hunting ptarmigan and mice. Fox families have overlapping home ranges up to 25 km^2. They are one of the mainstays of the trapping industry. The population is moderate, stable, and able to support considerable harvest pressure.

Coyote (1982 River Basin Harvest - 135)

Coyote were far more common in the Kluane area both years, although showing a decline in 1983. In the two seasons of surveys only one track was recorded from the North Canol. The trapper questionnaire and fur harvest data show that trappers preceive coyotes to be abundant and increasing in numbers. A decline is expected to occur concurrent with the grouse-hare declines. The coyote preferred open cover in 1982 (Kluane) but changed to dense cover in 1983 (Kluane), when lakes were avoided. They occurred in all vegetation types, exhibiting a preference for shrub birch (1982) and willow type (Kluane 1983) where snowshoe hare and ptarmigan respectively, were also common. Home ranges are overlapping with individual families ranging over an area up to 100 km^2.

Wolf

Wolf track densities were greatest in the Southern Lakes area and least in the North Canol. The track densities declined in all areas in 1983, although the fur harvest data and trapper questionnaire show that trappers preceive the population to be high and expanding. The species is difficult to trap and resilient to trapping pressure and is therefore grossly underutilized by trappers. An education campaign was initiated in 1983 with the objective of identifying the wolf as a valuable furbearer and teaching trappers proven trapping and snaring techniques. This action has been undertaken as part of the wolf-ungulate management plan.

The wolf preferred moderate to low cover (Southern Lakes 1982) and all terrain types. Wolves preferred the white spruce type in the

Southern Lakes area (both years). Wolf packs range over areas up to 720 km^2 in the Whitehorse area (90 km^2/wolf) (Bob Hayes, Y.T.G. Wolf Biologist, pers. comm., 1983), where prey is abundant. All biophysical habitat components could be expected to occur in such large areas, however, wolves should show preferences for movement corridors, hunting areas, etc.

Lynx (1982 River Basin Harvest - 3116)

Lynx were abundant in Kluane and Southern Lakes in 1982, and only in Southern Lakes in 1983, after a dramatic decline in Kluane. There was also an increase in lynx tracks in the North Canol in 1983. This illustrates a well documented shift of lynx from the main population centres to outlying areas during the hare population "crash".* Lynx preferred denser forested cover (Southern Lakes 1983). The 1983 trapper questionnaire showed a high and increasing population overall.

---

*Richard Ward (U.B.C. graduate student) radio-collared 7 lynx in the Kluane game sanctuary in 1982. During the winter of 1982/83, 5 of the animals left the Sanctuary and were subsequently trapped; two within 15 km, two within 220 km (Pelly Crossing) and one within 720 km (Fort Yukon, Alaska). (Richard Ward, pers. comm., 1983).

Red Squirrel (1982 River Basin Harvest - 8288)

Red squirrel was one of the most common furbearers, although relatively rare on the North Canol. The overall density was unchanged between years. Squirrels preferred moderate cover in all areas. Squirrel activity increased as temperatures moderated and foraging away from cone caches became more common. They preferred white spruce or mixed white spruce forest types which were common only in the Southern Lakes and Kluane study areas. Squirrels occupy exclusive territories about 0.25 to 0.50 hectares in size. The enormous cone crop of 1983 (personal observation) in the River Basin should fare well for the squirrel population for the next few years. The population is high, stable and is being underharvested.

Mouse Species

Mouse species (voles, deer mice, lemmings) were observed in moderate densities in all areas, apparently increasing in the Kluane area and decreasing elsewhere. They avoided low cover types. Although 10 or more species might be represented here, red-backed voles Clethrionomys rutilus and deer mice Peromyscus maniculatus are the most common small mammals in forested habitat in Yukon. In the Kluane area, red-backed voles are more abundant than they have been since 1972, including during the 1973 "peak" (Scott Gilbert, U.B.C. research assistant, pers. comm., 1983). Micotine species also appear more abundant than in previous years, and deer mice have been at the same level since 1976. (S. Gilbert, pers. comm., 1983).

Grouse and Ptarmigan

Grouse were rare in 1982, increasing in 1983, particularly, in the Southern Lakes area. The population peak was in 1979/80 in the southern Yukon (Dave Mossop, pers. comm., 1983; also trapper questionnaire analysis). Ptarmigan density was nil in Kluane in 1982 and high in 1983. Numbers were stable (low) in Southern Lakes and decreased in North Canol (moderate). Densities were greatest in shrub birch and willow dominated areas. The apparent increase in ptarmigan abundance in the Kluane area is seen as an artifact of predominantly low elevational sampling in 1982. The ptarmigan population also peaked in 1979/80 (Dave Mossop, pers. coom., 1983).

Snowshoe Hare

The snowshoe hare population peak in Yukon was in 1980/81 with numbers holding strong until early 1982 (Scott Gilbert, pers. comm., 1983; also trapper questionnaire). The decline in track densities between 1982 and 1983 was significant in Kluane and Southern Lakes. In the Kluane Lake snowshoe hare research area (University of British Columbia) hares have declined over 15-fold from a peak density of about 8 hares/ha to 0.5 hares/ha. Densities were stable but low in the North Canol study area. Snowshoe hare avoided low cover habitats in all areas tested except Kluane (1982), when populations were at their densest levels. Hare appeared to be more active early in winter (February) when colder temperatures prevailed. Hare habitat was found within all forest cover types, but avoided areas where trees were absent. Hares range over 0.1 to 0.25 km^2.

Porcupine

Porcupine tracks were uncommon in all areas, however many more were observed in 1983 than in 1982. Porcupines range over a very limited area (100 m^2) in winter, and move infrequently, making their encounter unlikely.

The utilization tables (Tables 9 through 15) also bear interpretations by habitat component.

Canopy Cover (Table 9)

The canopy cover index provided a good measure of selectiveness of forested vs. open habitats, particularly when used in conjunction with terrain. Few species preferred low canopy cover (hare and coyote/Kluane 1982; hare/Southern Lakes 1983).

Terrain (Table 10)

Open areas such as lake ice, rivers and streambeds were generally avoided by all species. Many species showed preference for riparian valley bottoms. No discrimination was involved in slope preference.

Slope Aspect (Table 11)

Most species were ubiquitous with respect to slope aspect preference.

Snow Depth (Table 12)

In most cases there was noted a preference for deeper snow conditions with the exception of the Kluane area (1983) where prey and predators alike showed an affinity for the least snow depth.

Temperature (Table 13)

There was a general avoidance of (reduced activity in) cold temperatures in the Southern Lakes area (both years) where such temperatures occur less frequently than in either of the other areas.

Date (Table 14)

There was a trend to reduced activity of most species (except squirrels) in late winter. This corresponds to warmer weather and also to reductions due to natural winter mortality and trapping.

Vegetation (Table 15)

The vegetation preferences were discussed in some detail with the species results. The importance of forest and shrub cover and the utilization of a wide range of vegetation types by most species was notable.

While the discussion of furbearer habitats is by no means complete (with regards to the preference tables) it is too lengthy for this paper. The reader is asked to read through the tables. One must also take with a grain of salt, our acceptance of the assumption that all 12 winter track observers used standard criteria to describe and classify the biophysical habitat components. It is hoped that the winter track-count technique can be further perfected in the future by standardizing methods used, particularly with regard to vegetation classification. The gross relative abundance indices given in Table 7, are believed to be an excellent measure of furbearer activity and hence abundance, in the Yukon River Basin study areas.

TRAPPING

Historical and Present Fur Resource Utilization

The natives of Southern Yukon (Athapascan) had a trade system established between themselves and the coastal Indians (Tlingits) long before the arrival of white man. Furs were trapped exclusively for subsistence use, (food and clothing) and items unique to each region were exchanged (Archibald et al 1977).

By the 1740's, Russians began trading for furs with the Alaskan Tlingits. Since the demand was for valuable mainland furs, the Tlingits would venture inland across coastal mountain passes and travel down the Yukon River drainage to trade with the interior natives. They would exchange European and Asian goods received from the white traders for inland furs. The Tlingit Indians held a monopoly on this fur trade until the mid 1800's. They guarded the mountain passes, not allowing the interior natives to deal directly with the white traders. Anxious to capitalize on this valuable resource, European traders bypassed the coastal Indians by entering the southern interior Yukon via the Liard River drainage. By 1848, Robert Campbell of the Hudson's Bay Company, had established posts on the Pelly and Yukon Rivers and soon the trappers were dealing directly with the trading posts rather than the coastal natives. Thus by the late 1800's, there was a "shift away from subsistence resource utilization towards an economically motivated exploitation" (Archibald et al 1977). As competition grew between the independent fur traders, trappers were extended credit for their "catch".

"This caused the trapper to make a long-term commitment to trapping and to rely less on other animals to meet his needs....Traders extended credit because it encouraged spending on goods which in time encouraged more trapping....The trader could influence the kind of animal the trapper took by refusing to trade certain goods unless a certain fur was offered" (McCandless 1977).

Thus the fur trade remained relatively stable until the gold rush of 1896. Not all miners struck it rich on their gold claims and many turned to trapping for survival. The pressure on the resource must have been tremendous. There were watersheds such as the Pelly and MacMillan Rivers that were said to have been trapped out entirely of species such as marten and beaver (McCandless 1977).

Fur retail merchants plied the Yukon River on steamers setting up depots around which settlements sprung up. Most trappers were centralized in the communities during the off season. Natives trapped in their traditional family units, returning to the settlements in the summer. Miners who trapped did so to grubstake their summer mining activities. "These people relied totally on traders for essentials to carry them over from one trapping season to the next" (Archibald et al 1977). Fur was always traded for goods, not cash. Trade practices seemed geared to keep money away from native trappers (McCandless 1977).

The fur industry in the Yukon would not stabilize again until the majority of miners had left. By 1920, Yukon's population had declined from the estimated high of 50,000 at the turn of the century, to 4000 (Bullen 1968). It was at this time that world markets began paying top price for fur. McCandless (1977), in his report "Trophies or Meat" stated that "when inflation factors are accounted for, Yukon fur is still only half as valuable as it was in the heydays of the twenties". Regulations were brought in to protect the furbearers from the over exploitation experienced during the post gold rush era.

Until 1948, the majority of trappers were native. After World War II, an increasing number of non-indians took up trapping as a profession (McCandless 1977).

By the 1950's, a trapline registration system was legislated to protect the investment of long time trappers and eliminate disputes over rights to certain trapping areas.

Fur prices dropped dramatically in the forties and remained low until the early 1970's. Although the annual fur harvest was the highest during this time, the dollar value did not rise accordingly (Table 16). Many traplines were abandoned towards the end of this period while trappers sought alternate sources of income. As fur prices began to increase, many people returned to the trapline. Recent fur harvests in the Yukon River Basin have yielded the highest dollar values ever recorded even though the total number of animals harvested has drastically declined (Table 17). The main reason for this drastic increase in dollar value is the record high prices being paid for long haired fur today.

Table 16. Total Yukon Fur Production

Fiscal Year	No. of Pelts Sold	Value of Production
1920/21	16,125	78,189
1921/22	69,796	203,402
1922/23	46,198	199,522
1923/24	50,070	347,079
1924/25	36,616	309,549
1925/26	35,767	320,803
1926/27	25,991	382,261
1927/28	64,375	610,348
1928/29	35,736	484,919
1929/30	108,632	295,492
1930/31	61,832	145,224
1931/32	57,679	132,268
1932/33	52,282	146,055
1933/34	43,803	122,999
1934/35	41,309	230,074
1935/36	42,768	276,946
1936/37	50,308	347,558
1937/38	67,655	295,857
1938/39	77,475	267,721
1939/40	80,617	288,292
1940/41	70,953	373,399
1941/42	66,700	398,132
1942/43	52,897	338,035
1943/44	78,005	467,188
1944/45	87,292	669,217
1945/46	107,252	677,495
1946/47	58,777	373,176
1947/48	131,227	230,177
1948/49	151,969	143,810
1949/50	153,574	199,086
1950/51	228,616	361,969

Table 16 (cont'd)

Fiscal Year	No. of Pelts Sold	Value of Production
1951/52	171,274	173,252
1952/53	246,379	247,001
1953/54	176,338	182,238
1954/55	213,515	242,944
1955/56	109,576	155,777
1956/57	108,102	108,873
1957/58	110,512	118,607
1958/59	103,604	67,571
1959/60	182,982	158,232
1960/61	116,787	105,031
1961/62	98,902	125,348
1962/63	259,137	846,420
1963/64	86,394	171,209
1964/65	70,995	172,936
1965/66	22,308	64,929
1966/67	43,915	92,837
1967/68	56,483	81,234
1968/69	54,300	104,612
1969/70	26,850	70,673
1970/71	13,891	44,762
1971/72	21,340	136,007
1972/73	41,045	339,437
1973/74	34,684	499,001
1974/75	30,905	403,543
1975/76	28,851	363,073
1976/77	54,124	430,105
1977/78	36,648	420,006
1978/79	41,580	927,814
1979/80	52,800	917,048
1980/81	38,920	1,318,875
1981/82	32,686	1,577,178

Table 17 Fur Harvest and Dollar Value of the Harvest from the Yukon River Basin for Seven Years

SPECIES	1976		1977		1978		1979		1980		1981		1982	
	No. Harvested	$ Value	No. Harvested	$ Value	No. Harvested	$ Value	No. Harvested	$ Value	No. Harvested	$ Value	No. Harvested	$ Value	No. Harvested	$ Value
Beaver	487	6725	465	11,118	453	7336	710	24,196	908	33,051	623	20,196	436	8916
Coyote	61	3676	76	3969	155	7920	98	6993	134	7236	104	6411	151	9478
Fisher	-	-	-	-	-	-	-	-	-	-	-	-	2	360
Coloured Fox	186	16,068	119	6325	175	9620	244	26,232	380	27,975	501	52,534	548	43,910
White Fox	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lynx	543	119,867	251	68,454	440	110,241	1041	358,041	1836	385,780	2385	683,660	3148	1,012,522
Marten	732	20,620	1106	22,772	2225	55,180	2901	103,365	3176	114,970	2553	96,222	2342	104,617
Mink	69	959	152	2862	284	3634	355	9734	644	17,027	458	15,704	469	16,138
Muskrats	1006	4989	2334	11,623	3060	12,514	3090	17,613	2796	17,419	1619	10,037	771	2166
Otter	25	1693	21	1371	48	1927	25	1582	43	2525	23	1482	15	672
Squirrel	5657	4525	6673	4070	11,085	11,528	9414	19,769	26,002	44,202	9829	13,760	8266	13,887
Weasel	105	118	384	330	374	426	346	574	254	271	134	177	96	175
Wolf	97	8420	49	4121	59	4802	76	9244	54	4702	52	4628	55	6524
Wolverine	178	22,230	134	22,801	125	15,954	143	24,557	89	12,516	58	11,020	85	18,010
TOTALS	9146	209,890	11,764	159,816	18,483	241,102	18,443	602,100	36,317	667,814	18,339	915,831	16,384	1,237,402

Until recently, the majority of the total value of the fur harvest was attributed to white trappers. White trappers were more economically motivated and geared their trapping efforts accordingly, almost to the exclusion of other furbearers. Native trappers, on the other hand, harvested those species which had traditional and social significance (ie. beaver and muskrat). The elderly still view spring trapping as an annual social event. Renewed interest in trapping as a lifestyle and occupation combined with continued high prices, have made the native trapper more aware of the value of the fur resource.

Today there are 299 registered trapping concessions, 8 radius areas and 3 group areas within the Yukon River Basin study area (Appendix 1, Map 1). Twenty-eight of these concessions and one of the group areas are in northern British Columbia. The group areas are large concessions administered by the local Indian bands. The radius areas vary in size (2 mile to 5 mile radius) and encompass or border communities. These areas protect residents from heavy trapping pressure, yet, allow disabled people, pensioners or youngsters an opportunity to trap. Approximately 350 licenced trappers are active on the registered traplines, 50 on the group areas, and 10 on the radius areas.

Table 17 outlines the total number of animals caught and the dollar value of the harvest per year for the last 7 years. Table 18 compares the value of the fur harvest within the basin to Yukon's total fur production. The highest proportional value of the fur

Table 18 Comparison of Fur Harvest Nominal Dollar Value Between The Yukon River Basin and the Total Yukon Territory*

YEAR	YUKON RIVER BASIN	TOTAL YUKON HARVEST*	% OF TOTAL
1976	209,890	373,118	56%
1977	159,816	442,736	36%
1978	241,102	438,116	55%
1979	652,100	948,004	69%
1980	667,814	947,683	70%
1981	915,831	1,349,483	68%
1982	1,237,108	1,620,472	76%

*including the harvest from the Yukon River Basin in B.C.

harvest within the Yukon River Basin is attributed directly to one species; trappers in the study area take 82% of the total number of lynx caught in the Yukon (3148 vs 3847 in 1982). Lynx is the most valuable furbearer with recent sales averaging in excess of $300.00 per pelt. Extensive 25 year old burns within the study area have created excellent habitat for this species.

Resource Capability

As stated previously, present fur harvest levels are considerably less than historical all time highs for most species. Fewer people residing in the territory and less dependence on trapping for an income are probably the two main reasons. It is generally felt that our fur resource could support an increase in harvest, therefore, a decline in the abundance of furbearer species is not suspected as the reason for a decline in the annual harvest.

Recently, however, there has been a change in people's attitudes toward trapping. The number of concession applications exceeds the supply of vacant lines, indicating a rising interest in trapping as a lifestyle and occupation. With this renewed interest in trapping and the record high prices being received for fur, the Department of Renewable Resources recognizes the need to develop management plans that will ensure maximum harvest, and yet, guarantee the perpetuity of the fur resource.

Fundamental to a biologically sound fur program are standing crop inventories, habitat assessment, and seasonal monitoring of resource utilization on an area specific basis. The Yukon River Basin furbearer inventory study is a major step in the development of such a program. One of the most frustrating dilemas encountered when attempting to manage the fur resource is the fluctuating fur prices. The disproportionate financial return per species has resulted in trapper effort on select species, often to the detriment of the resource. This makes it necessary to educate the trapper in the biological management of his trapline. The responsibility of fur management ultimately lies on the shoulders of the trapper. As biologists, we provide the tools and information necessary to effect proper management.

Lynx and marten are the two most valuable furbearer species in the Yukon River Basin. Recent marten harvests have exceeded historical highs and they may be approaching upper harvestable limits. In addition, there are large areas of the basin that have very few marten as a result of past over-exploitation and habitat destruction by a large burn in 1958. A short season (four months) and trapper education on the biological management of marten will aid in protecting this species from over harvest. In addition, reintroductions are planned for select areas of the basin, beginning in 1984, to speed up the natural immigration that is presently occurring.

Lynx populations are presently approaching the low of their 10 year cycle. There is concern that heavy trapping pressure during this low period could affect the natural recovery of the population and result in a lower "high" than the species' potential. Trappers are asked to closely monitor lynx populations on their lines and reduce their effort over the next 3-4 years.

Wolverine are also susceptible to overtrapping and close monitoring of the harvest is required. A present study underway will help determine the productivity of wolverine, habitat preference, and harvest potential for the Yukon.

Members of the canid family, (ie. fox, coyote, and wolf) seem quite withstand adapt to trapping pressure although fluctuations in the prey base will, to a large extent, influence their numbers. There are no concerns about overharvesting any of these species. The semi-aquatics, such as beaver and muskrat, are presently being underutilized within the basin. This is a direct result of the fur prices being offered for these species. Mink, weasel and otter are not considered prime fur by most trappers and as a result, there is very little pressure on them. Squirrel harvests are nowhere near their potential probably due to low market value. The majority are harvested by the elderly, and the young trappers in the family. The harvest of fisher will always be incidental as the Yukon River Basin study area is at the extreme north west of its range.

There are presently many areas of the Yukon River Basin being underutilized and some areas are not being trapped at all. A few traplines are being harvested at allowable limits but only for select species. The fur resource in the basin has a higher harvest potential. Trapper effort across the entire spectrum of furbearers would increase the harvest levels as well as the dollar value. It is doubtful, however, that this will occur unless fur prices become more stable. In the meantime, the growing interest in trapping and the high prices for longhaired fur will continue to ensure that fur resource will be a million dollar industry in the Yukon River Basin.

The fur resource is also utilized by resident and non-resident big game hunters who are permitted unlimited takes of wolves and coyotes, and one wolverine, per year. The approximate annual harvest of these species by some 5500 hunters is 85, 20 and 15 respectively.

The non-market value of furbearers to Yukon residents and tourists is immeasurable. The habits of beaver, muskrat and squirrel are fairly predictable, making them favourites of the amateur naturalists. The thrill of observing and perhaps photographing the more crepuscular varieties in their natural habitats is one added incentive to venturing into the wilds of Yukon. Red fox, coyotes and wolves are frequently seen along the roadways. Wolf "howling" trips, where groups of interested naturalists solicit the howls of wolf packs by playing tape-recorded howls or by imitating them, are becoming increasingly popular in eastern North America and only serve to remind us of the non-market value of intact populations of wild animals.

Resource Conflicts

The following discussion serves to illustrate the problems and issues which are associated with impacts on furbearer populations, habitats and user groups. The following general discussion on types of impacts is summarized from Slough (1983).

Potential Impacts on Furbearer Populations and Trapping Activities

Habitat Loss   Permanent or Temporary

All potential developments could contribute to habitat loss. In some cases it could be permanent and in some, where reclamation is planned, temporary. Reclamation of subalpine and alpine areas and disturbed wetlands is more difficult and time consuming than that of forested habitats. Alterations of hydrologic regimes could have widespread impact on beaver, muskrat, mink and otter habitats. In all cases there is some disruption of trapping activities.

Pollution

Air pollution is significant if it effects the growth and quality of plant species on which all wildlife inevitably depend.

Water pollution, including sedimentation, has little direct impact on semi-aquatic furbearers, however impacts on aquatic vegetation could effect beaver and muskrat. Otter and mink are dependent on fish and other aquatic fauna which are sensitive to both chemical and biological pollution and sedimentation. All species are vulnerable to oil spills which often kill contaminated animals.

Disturbance

Construction and operational phases of developments present several types of disturbances to wildlife populations. These include:

a) general disturbance caused by vehicular traffic, human presence, noise (blasting), etc.

b) disruption of movements caused by disturbance on transportation corridors and site specific facilities, and by physical breaks in habitat continuity.

c) direct mortality caused primarily by vehicular traffic.

Larger animals such as wolves, lynx and wolverine are most likely to react to disturbance, whereas species with smaller territories such as squirrel, ermine and marten, will be effected to a lesser extent. The degree of impact on all species is in fact speculative as little empirical data is available on the effects of disturbance.

Larger species should similarly be more vulnerable to disruptions of movements by disturbance on transportation corridors and to direct mortality. Some species, such as squirrel, avoid crossing extensive clearings such as roadways and transmission lines.

We will now discuss impacts on furbearers and trapping in relation to some specific projected developments for Yukon.

Hydro-Electric Power Development

Several potential hydro projects have been planned for the Yukon River Basin. Three possible sites are Five Fingers on the Yukon River, Granite Canyon on the Pelly River and Fraser Falls on the Stewart River. Other sites being considered include sites on the

Primrose, Pelly and Teslin Rivers. The damming of rivers has severe adverse affects on furbearers and trapping with little, if any, positive benefits.

The immediate effect is loss of habitat resulting from flooding by water reservoirs. The rivers selected for hydro sites are old rivers with large floodplains that have a vegetation cover dominated by willows and balsam poplar and which have many potholes with submergent and emergent aquatic vegetation, as well as sedge meadows surrounding such potholes (Hoefs 1975). These areas are of great importance to aquatic furbearers such as beaver, muskrat, otter and mink.

Since the entire Territory is divided into registered traplines, the hydro reservoir will eliminate portions of productive trapping areas from one or more trapping concessions. The potential for severe financial loss is great, depending on the number of established trapping trails and line cabins within the floodplain of the reservoir. In addition, "there are problems with the natural fluctuations of water levels of power reservoirs compared to natural, seasonal fluctuations of rivers and lakes. Water level changes in reservoirs are largely determined by power demands, and therefore often very different from seasonal trends" (Hoefs 1975). The result is unstable wetland habitat that can adversely affect aquatic furbearers. The Yukon River, upstream from the NCPC control gate south of Whitehorse is a good example. The 1982 spring muskrat survey indicated the area was productive muskrat habitat. In 1983, no pushups were sited. The water levels had dropped dramatically because NCPC increased the outflow. Mink and otter are also dependent on the air space under the ice surface produced by natural winter drawdown.

Loss of habitat by flooding is an immediate direct effect. An indirect effect that may have a greater impact on furbearers and trapping activity over a longer period of time is access into previously remote areas created by construction roads and power transmission lines. Such access will enhance trapping operations but will also increase conflicts between trappers and other users of the roads. Exploitation levels may reach the fur resource capability and tighter management control may be necessary (through open seasons, quotas, etc.).

Mining

Very little research has been conducted on the effects of mining on furbearers and their habitat in Yukon. It is suspected that direct disturbance resulting from the mining acitivity would affect only a small portion of a trapping area. Yukon's large metal mines have been established for several years and their presence is generally accepted by the trapping community. Placer mining, although quite capable of severe habitat disruption, is shut down during winter; the trapping season. Conflicts have risen between miners/prospectors and trappers when the two parties have chosen to utilize an access road at the same time. In most cases, trappers are happy to have mining companies push tote roads across their traplines. It provides access and opens up areas previously untrapped. However, miners gaining winter access to their claims have disrupted trapping activities by clearing a tote road being used by a trapper. Most disputes are avoided by cooperative arrangements made prior to the road being opened.

Forestry Operations

Since the Yukon Territory is blanketed with registered trapping areas, exploitation of the forest resource will definitely overlap trapping. A potential direct conflict exists between the two different resource users. For example, recent wood cutting operations in the Takhini burn have effected the trapping efforts of one registered concession holder. In addition, timber harvesting may adversely affect furbearer populations through disruption of their habitat.

It is suspected that forestry operations would have little effect on the abundance of aquatic furbearers simply due to their wetland habitat preference. Indeed, seral growth of aspen along rivers, lakes or ponds following the removal of mature forest stands can reasonably be expected to enhance the occurrence of beaver (Beaver 1978). However, most of our terrestrial furbearers make use of a variety of habitat types including mature forest stands as well as open regenerating clearings. The forest resource utilization could have a detrimental effect on these species.

The majority of our fur harvesting takes place in mature forest stands. It is vital to protect these old growth vegetative communities for the overwintering requirements of all terrestrial species. It takes between 100 and 200 years for these areas to reach climax in Yukon. In areas that had been clearcut or burnt extensively, it may be void of those furbearer species (eg. marten, squirrel, weasel) that require mature forest stands for most of that time.

In a recent report titled "Furbearers and Forest Management in Yukon", Urquhart (1983) states that "future forest management policies should incorporate trapping interests as a significant component in a multiple use system". He goes on to state that the goal of forest management should be designed to create a variety of habitats to maintain wildlife diversity. Preferably, forest resource exploitation should be carried out on a moderate scale leaving large blocks of mature forest intact and connected with corridors. The timing of operations could be arranged so as to avoid direct conflicts with trappers.

Recreational Land Use

Trapping is not compatable with some winter recreational land use practices. Numerous conflicts have erupted between the trapper and other outdoor enthusiasts. Trappers have had their efforts hampered by people disturbing their traps and trails and, in some severe cases, have experienced theft. Recreationalists, on the other hand, have expressed displeasure at seeing wild animals trapped and in many cases have had their own pets caught in traps.

In every case, the trapper must make the effort to avoid future encounters. This generally means cutting new trails and moving traplines. One conflict resulted in a trapper relinquishing his rights to the registered concession for an agreed amount of compensation. Trappers are encouraged to avoid recreationally developed areas and post their trapping trails.

The public (and all developers for that matter) is asked to respect the livelihood of the trapper by staying off trails marked as traplines. There is limited protection for both under the Wildlife Act. Section 35(1) states "No person shall intentionally remove, molest, spring or in any way interfere with a trap lawfully set by another person for trapping wildlife". Section 10(1) states "No person shall hunt wildlife within one kilometre of an occupied dwelling on private land unless he has the permission of the occupant to do so". Section 33(3) states "No person shall at any time set a trap on the travelled portion of a road that is normally used by the public".

MANAGEMENT RECOMMENDATIONS

1. Trapping has never been recognized as a legitimate land-based industry, and has therefore received little consideration in the development of land use policies. However, recent changes in federal government policy may turn this around. The Department of Indian and Northern Affairs has developed a trapline cabin policy which protects the investments of the concession

holder. The trappers concerns are recognized in land use permits and generally call for a co-operative attitude between the different resource users. Land management policies whether federal or territorial should incorporate furbearer habitat protection and trapping interests (in future) as significant components of a multiple use system.

2. In an effort to standardize trapper compensation claims against all private corporations, federal and territorial departments and agencies, and individuals, for damages suffered as a result of interference with trapping operations, it is recommended that all claims be processed by the Yukon Territorial Government's Concession and Compensation Review Board, appointed pursuant to Section 168(1) of the Wildlife Act. The Concession and Compensation Review Board regulations are in draft form, however should be able to handle third party claims as well as claims against Y.T.G., through a member of the Board who will be designated a "Trapper's Advocate". The Trapper's Advocate will attempt to mediate between the trapper and the third party. If no agreement between the trapper and the other party can be reached, legal action may be recommended. The Wildlife Act does not affect the rights or remedies any person has in common law against any other person, other than the Crown, for damages suffered as a result of interference with trapping operations (S.87). Compensation guidelines are also in draft form at the present time.

3. Furbearer populations and their harvest should continue to receive regular monitoring by the Yukon Wildlife Management Branch.

Literature Cited

Archibald, W.R., W.J. Klassen and J. MacDonald. 1977. The history, development and present direction of the fur industry in the Yukon Territory. Report presented at the third annual Western Fur Managers Conference. Edmonton, Alberta.

Archibald, W.R. 1978. The future of trapping. Paper presented at the fourth annual Fur Managers Conference. Yellowknife, N.W.T.

Archibald, W.R. and R.H. Jessup. 1983. Population dynamics of the pine marten (Martes americana) in the Yukon Territory. Yukon Dept. of Renewable Resources. Unpubl. M.S. 30 pp.

Beaver, R. 1978. An evaluation of the impact on furbearers of the Alaska Highway realignment. Prepared for Canada Department of Public Works and Yukon Game Branch. 26 pp.

Bullen, E.L. 1968. An historical study of the education of the Indians of Teslin. M. Ed. Thesis, U. of Alberta.

Dennington, M.C. and B. Johnson. 1974. Studies of beaver habitat in the MacKenzie Valley and Northern Yukon. Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development. Rep. No. 74-39.

Hoefs, M. 1975. The potential effects of various hydroelectric power proposals on wildlife in the Yukon. Yukon Dept. of Renewable Resources. Unpubl. M.S., presented at a seminar on hydroelectric power proposals sponsored by the Yukon Conservation Society. 15 pp.

McCandless, R.G. 1977. Trophies or Meat: Yukon Game Management 1896 to 1976. Prepared for Yukon Game Branch. 122 pp.

Neu, C.W., C.R. Byers and J.M. Peek. 1974. A technique for analysis of utilization-availability data. J. Wildlife Management 38:541-545

Penner, D.F. 1979. Furbearer studies in the Liard River Valley, British Columbia. Prepared by McCourt Management Ltd., for British Columbia Hydro and Power Authority. 121 pp.

Slough, B.G. and R.M.F.S. Sadleir. 1977. A land capability classification system for beaver (Castor canadensis Kuhl). Can. J. Zool. 55: 1324-1335.

Slough, B.G. 1982. Preliminary investigation of the muskrat population and harvest of Old Crow Flats and Northern Yukon. Wildlife Management Branch, Yukon Department of Renewable Resources. Typescript. 16 pp.

Slough, B.G. 1983. 1981-82 Furbearer inventory, habitat assessment and trapper utilization of the North Canol-MacMillan Pass development area. Wildlife Management Branch, Yukon Department of Renewable Resources. Typescript. 40 pp.

Stevens, W.E. 1955. Adjustments of the northwestern muskrat (*Ondatra zibethicus spatulatus*) to a northern environment. Unpubl. Ph. D. thesis, U.B.C. 194 pp.

Urquhart, D.R. 1983. Furbearers and forest management in Yukon. Prepared for Forest Resources Division, Northern Affairs Program, Department of Indian Affairs and Northern Development. 142 pp + appendices.

APPENDIX I

Map 1 Trapping Concessions

Map 2 1982 & 1983 Beaver Food Cache Survey Results

Map 3 Observed Muskrat Pushup Density 1982

Map 4 Observed Muskrat Pushup Density 1983

Furbearer Inventory, Habitat Assessment and Trapper Utilization of the Yukon River Basin. January 1984. Slough, B.G. and R.H. Jessup, Wildlife Management Branch, Government of Yukon, Whitehorse

Project Report: Wildlife No. 1

REVIEW

R.A. (Tony) Hodge
February 20, 1984

This report was completed for Yukon River Basin Study Projects 28 Furbearer Track Sampling and 38 Furbearer Inventory. The combined budget for the three year study was $103,000.

Summary

Project 28 Furbearer Track Sampling

This initial phase of the furbearer study involved field tests of track counting techniques that had not previously been used in Yukon. Different test areas were identified using such characteristics as major tree species or shrubs present. These areas were crossed by snowshoe, ski or snowmobile and along each line or "transect" an inventory was made of all tracks. Data recorded during each transect included the number of tracks of each species, the number of days since last snowfall, the vegetation type, canopy cover, terrain, slope aspect, snow depth and temperature. The results of the technique allow identification of a species preference or avoidance of a given area.

Three study areas were chosen for intensive sampling including the North Canol, Kluane Lake and Southern Lakes region.

Field testing procedures were successful and the results were used as part of the furbearer inventory project.

Project 38 Furbearer Inventory

In addition to the winter track count studies described above, the furbearer inventory included regional surveys of both muskrat and beaver. Muskrat populations are estimated by counting the hollow feeding stations (or "pushups") constructed on the ice surface. Ideal pushup survey conditions exist when the snow has melted to expose the pushup. Survey areas included major portions of the White River drainage, mainstem Yukon, Teslin River. Ross River. Pelly River, Big Salmon River, MacMillan River, Hess River and Stewart River.

Beaver population estimates were made by counting food caches. Before freeze-up, beaver colonies build caches (or feed piles) in the water close to their lodges. The caches are most visible from the air after leaf-fall and before freeze-up. Each cache represents one colony and by assuming the number of beavers in a colony, an estimate can be made of total beaver numbers. Survey areas included the upper Yukon mainstem, Teslin River, Nisutlin River, Big Salmon River. Ross River and Pelly River.

The inventory work was combined with harvest data obtained from ongoing trapper questionnaires to develop an estimate of population, population trends and habitat characteristics for each furbearing species.

Wolves, red fox, coyote, red squirrel, weasel, marten, mink, otter, wolverine beaver, muskrat and lynx are all widely distributed within the Yukon River Basin. All populations except marten are believed to be healthy within the context of "available" habitat for each species and recognizing that natural population fluctuations occur. The marten was found to be rare in the southern Yukon between Kluane Lake and Teslin Lake. This absence is likely caused by a combination of overharvest and fire (1958) and sustained by trapping pressure which is preventing recolonization of maturing habitat. Wolverine, lynx and marten are harvested near the upper limit of a sustainable harvest. Muskrats are declining in a phase of an apparently natural cycle.

In 1982 the value of the fur harvest of the River Basin exceeded $1 million and represented 78% of the total Yukon fur harvest. Lynx contributed 82% of this total, marten 8%, fox 4%, wolverine 1%, mink 1% and squirrel 1%. Some 350 to 400 trappers are annually employed (part time or full time) by trapping.

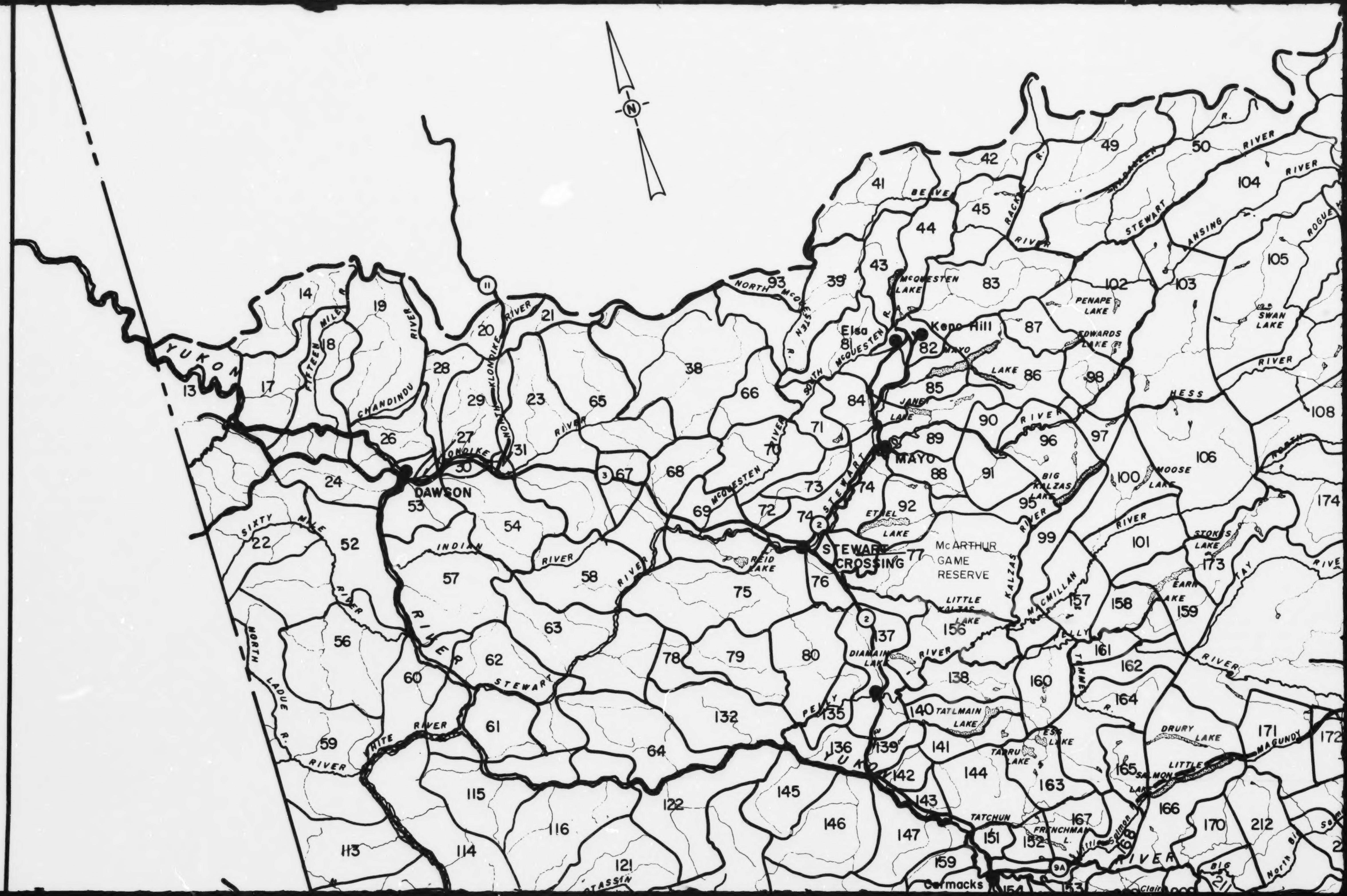
Potential impacts on furbearer populations and trapping activities include permanent or temporary habitat loss, air and water pollution and disturbance. Of these, permanent habitat loss is the most severe impact.

APPENDIX II

(Attached under separate cover).

Annotated Bibliography and Information Summary on the Furbearer Resource and Trapping Industry of the Yukon River Basin

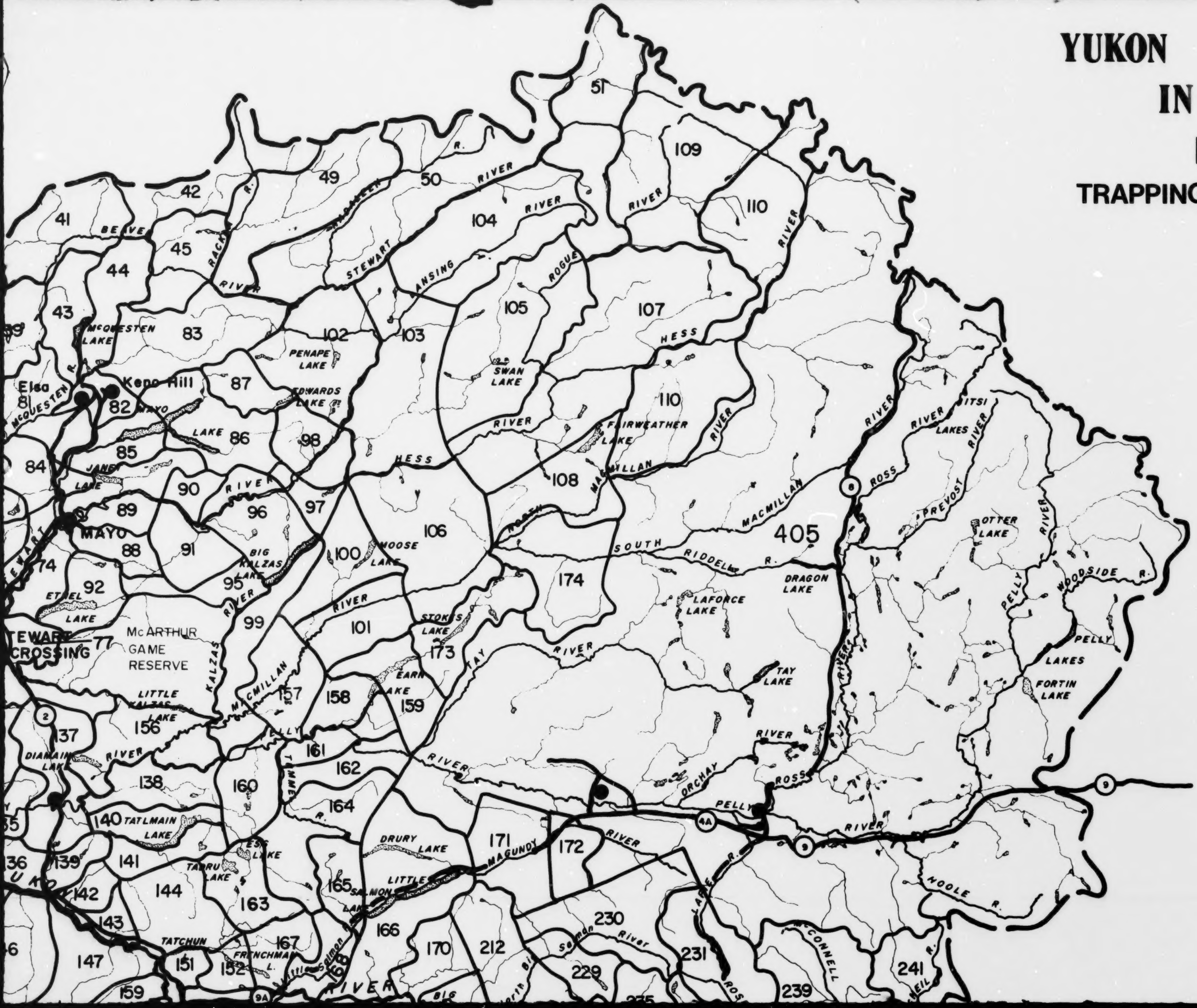
by C.M.M. Smits

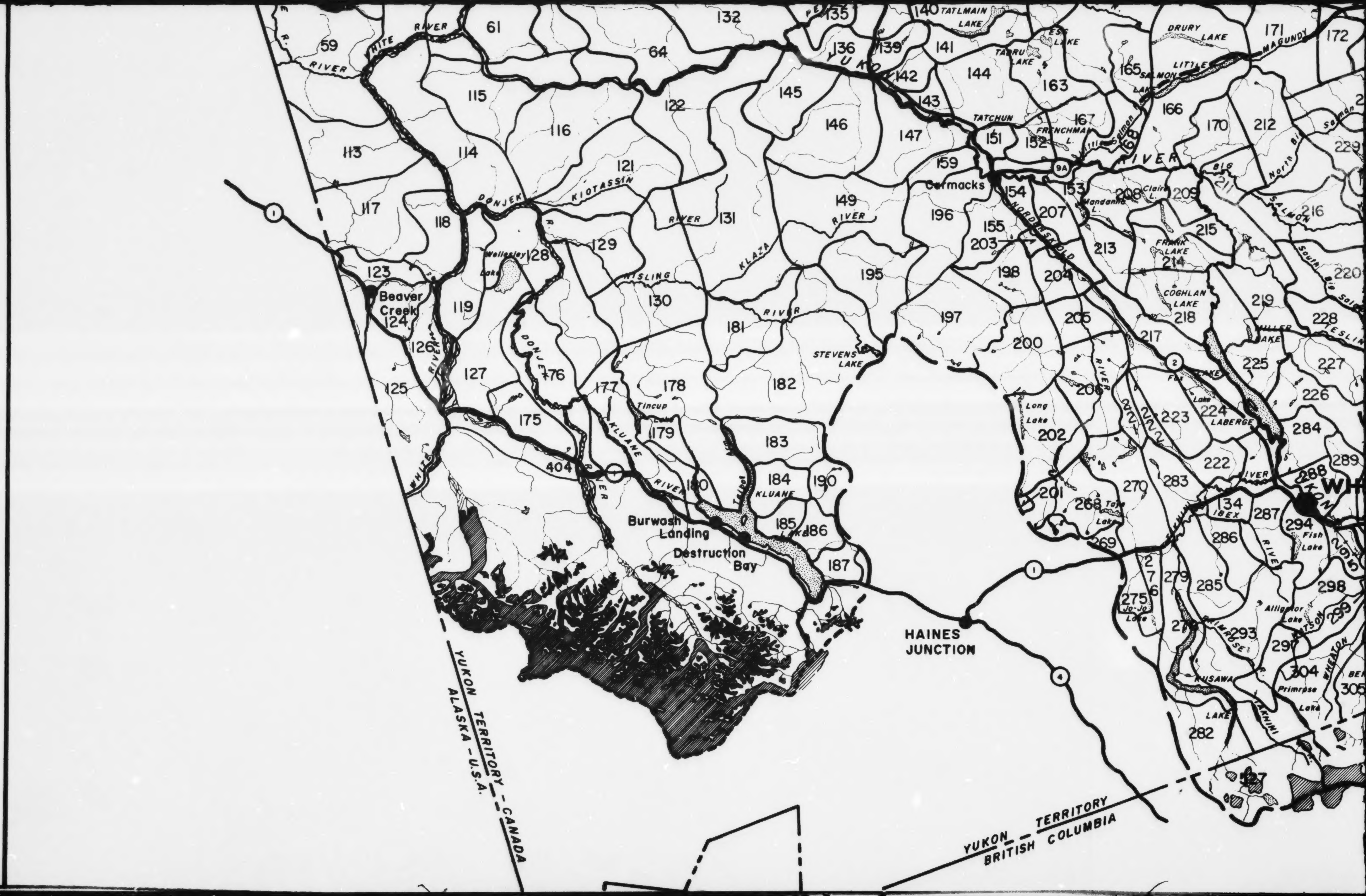
N
YUKON
DAWSON
MAYO
Elsa
Keno Hill
STEWART CROSSING
McARTHUR GAME RESERVE
Carmacks
TATCHUN
FIFTEEN MILE
CHANDINDU
RIVER
KLONDIKE RIVER
NORTH KLONDIKE
SIXTY MILE
INDIAN
STEWART
NORTH LADUE R.
WHITE RIVER
NORTH McQUESTEN
SOUTH McQUESTEN
McQUESTEN LAKE
McQUESTEN R.
McQUESTEN RIVER
BEAVER
RACKLA R.
STEWART RIVER
LANSING
ROGUE
PENAPE LAKE
EDWARDS LAKE
SWAN LAKE
MAYO LAKE
JANET LAKE
HESS RIVER
BIG KALZAS LAKE
KALZAS RIVER
MOOSE LAKE
ETHEL LAKE
REID LAKE
LITTLE KALZAS LAKE
MACMILLAN
STOKES LAKE
EARN LAKE
TAY RIVER
PELLY RIVER
DIAMAIN LAKE
TATLMAIN LAKE
ESS LAKE
TADRU LAKE
DRURY LAKE
MAGUNDY
LITTLE SALMON LAKE
FRENCHMAN L.
Little Salmon
TATASSIN
Big
North Big
Claire
2
3
9A
11
13
14
17
18
19
20
21
22
23
24
26
27
28
29
30
31
38
39
41
42
43
44
45
49
50
52
53
54
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
95
96
97
98
99
100
101
102
103
104
105
106
108
113
114
115
116
121
122
132
135
136
137
138
139
140
141
142
143
144
145
146
147
151
152
153
154
156
157
158
159
160
161
162
163
164
165
166
167
168
170
171
172
173
174
211
212

YUKON RIVER BASIN IN CANADA

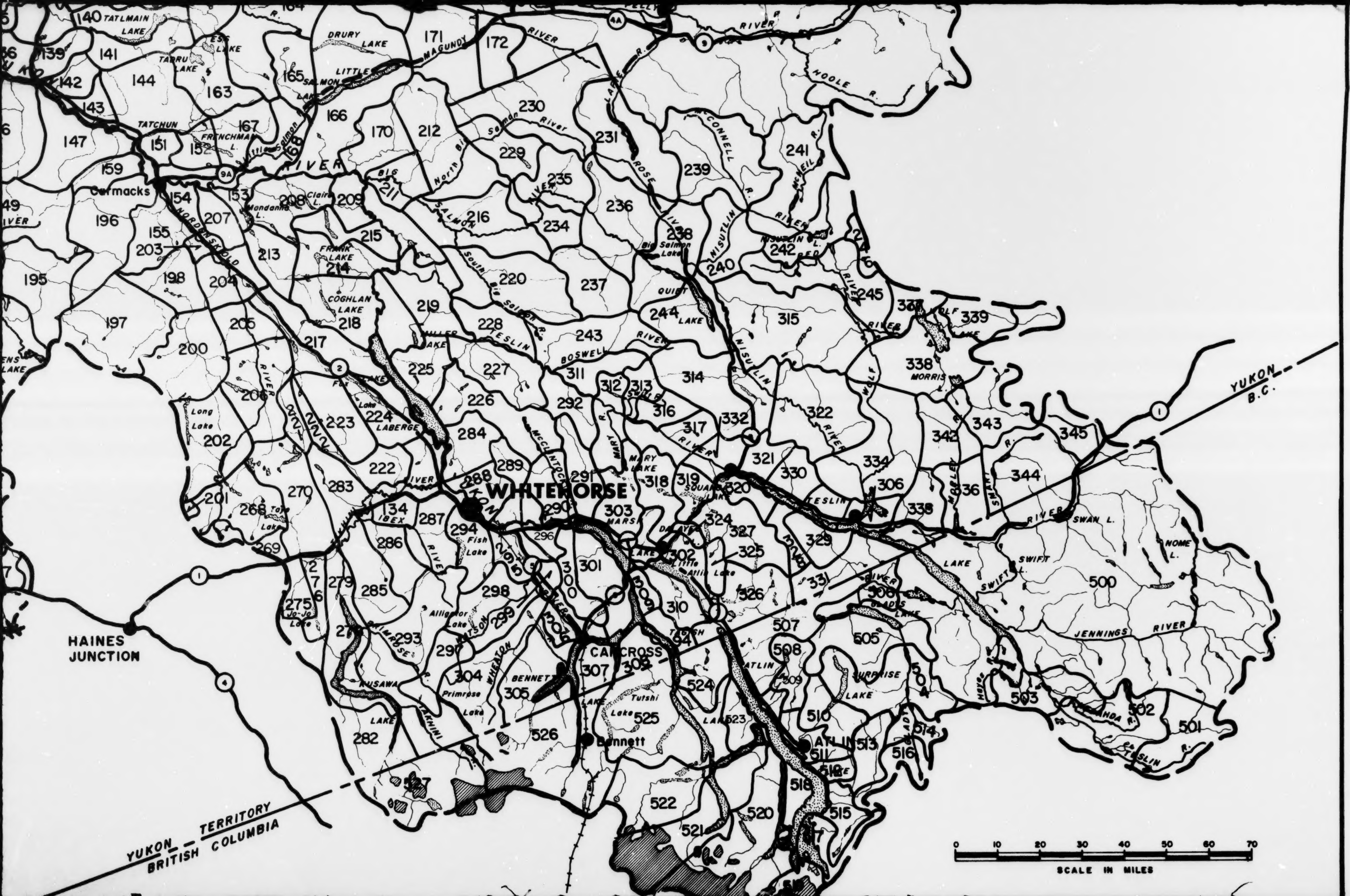
MAP 1

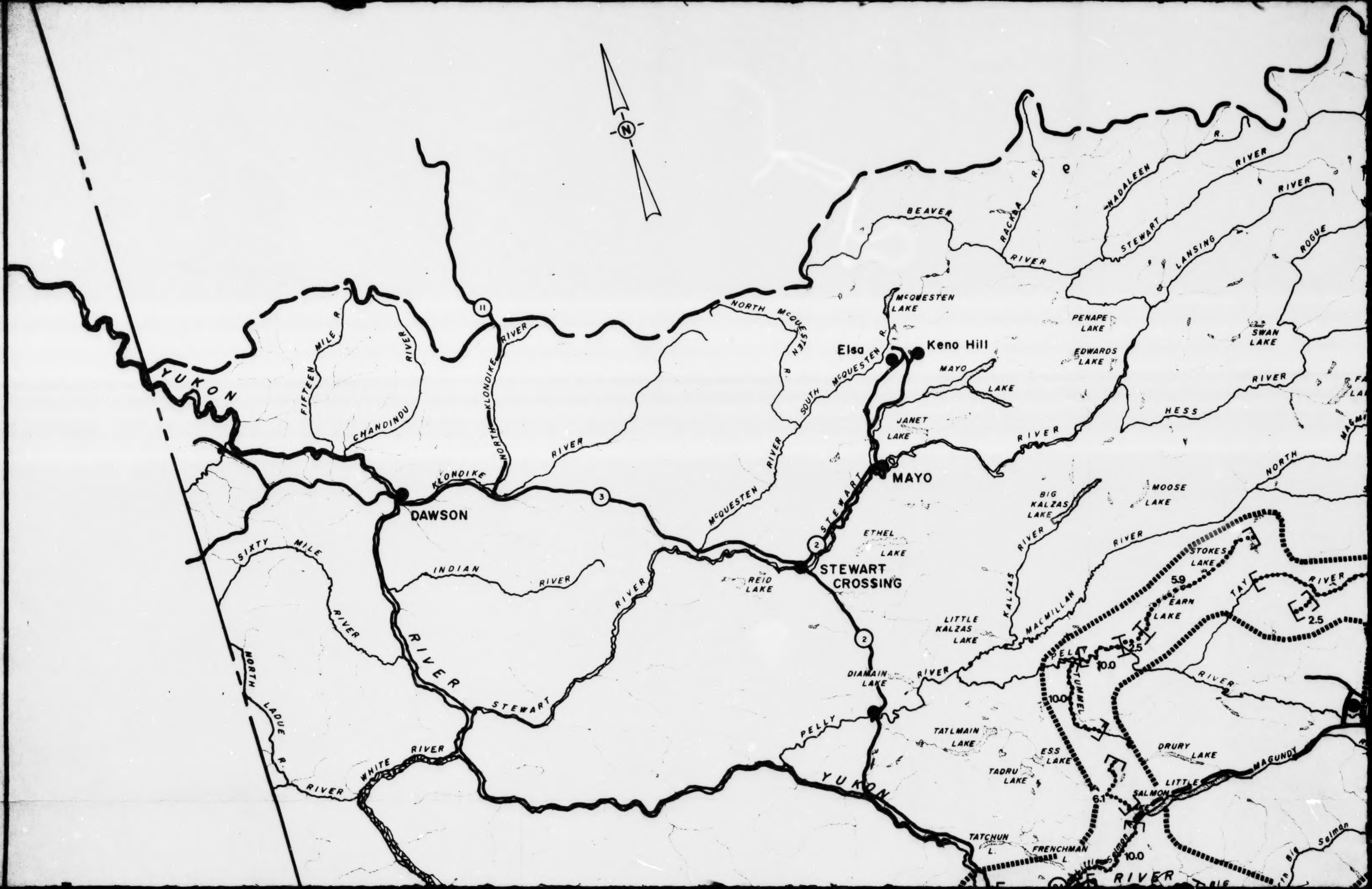
TRAPPING CONCESSIONS


51
109
110
42
49
50
R.
RIVER
41
BEAVER
45
RACK R.
104
RIVER
RIVER
RIVER
44
RIVER
STEWART
LANSING
ROGUE
43
McQUESTEN LAKE
83
102
103
105
107
HESS
PENAPE LAKE
SWAN LAKE
Elsa
81
Keno Hill
82
87
EDWARDS LAKE
110
McQUESTEN R.
MAYO
LAKE
86
98
RIVER
FAIRWEATHER LAKE
RIVER
RIVER
RIVER
SITSI LAKES
RIVER
85
HESS
MACMILLAN
84
JANET LAKE
90
RIVER
97
108
ROSS
96
106
NORTH
MACMILLAN
PREVOST
OTTER LAKE
RIVER
89
MAYO
88
91
100
MOOSE LAKE
SOUTH
405
STEWART
74
BIG KALZAS LAKE
95
RIDDELL R.
DRAGON LAKE
92
174
WOODSIDE R.
ETHEL LAKE
RIVER
LAFORCE LAKE
PELLY
99
101
STOKES LAKE
PELLY LAKES
STEWART CROSSING
77
McARTHUR GAME RESERVE
KALZAS
173
TAY
RIVER
TAY LAKE
RIVER
FORTIN LAKE
EARN LAKE
LITTLE KALZAS LAKE
MACMILLAN
157
158
159
2
137
156
PELLY
DIAMAIN LAKE
RIVER
161
RIVER
RIVER
162
ROSS
138
TIMMEE R.
160
ORCHAY
PELLY
4A
9
164
35
140
TATLMAIN LAKE
DRURY LAKE
171
RIVER
RIVER
ESS LAKE
172
MAGUNDY
9
36
139
141
TARRU LAKE
144
LITTLE
165
SALMON LAKE
LAKE R.
HOOLE R.
YUKON
142
163
230
143
166
167
170
212
Salmon River
McCONNELL
46
147
TATCHUN
151
152
FRENCHMAN L.
Little Salmon
168
231
241
NEIL R.
159
9A
RIVER
BIG
North Big
229
ROSS
239
235

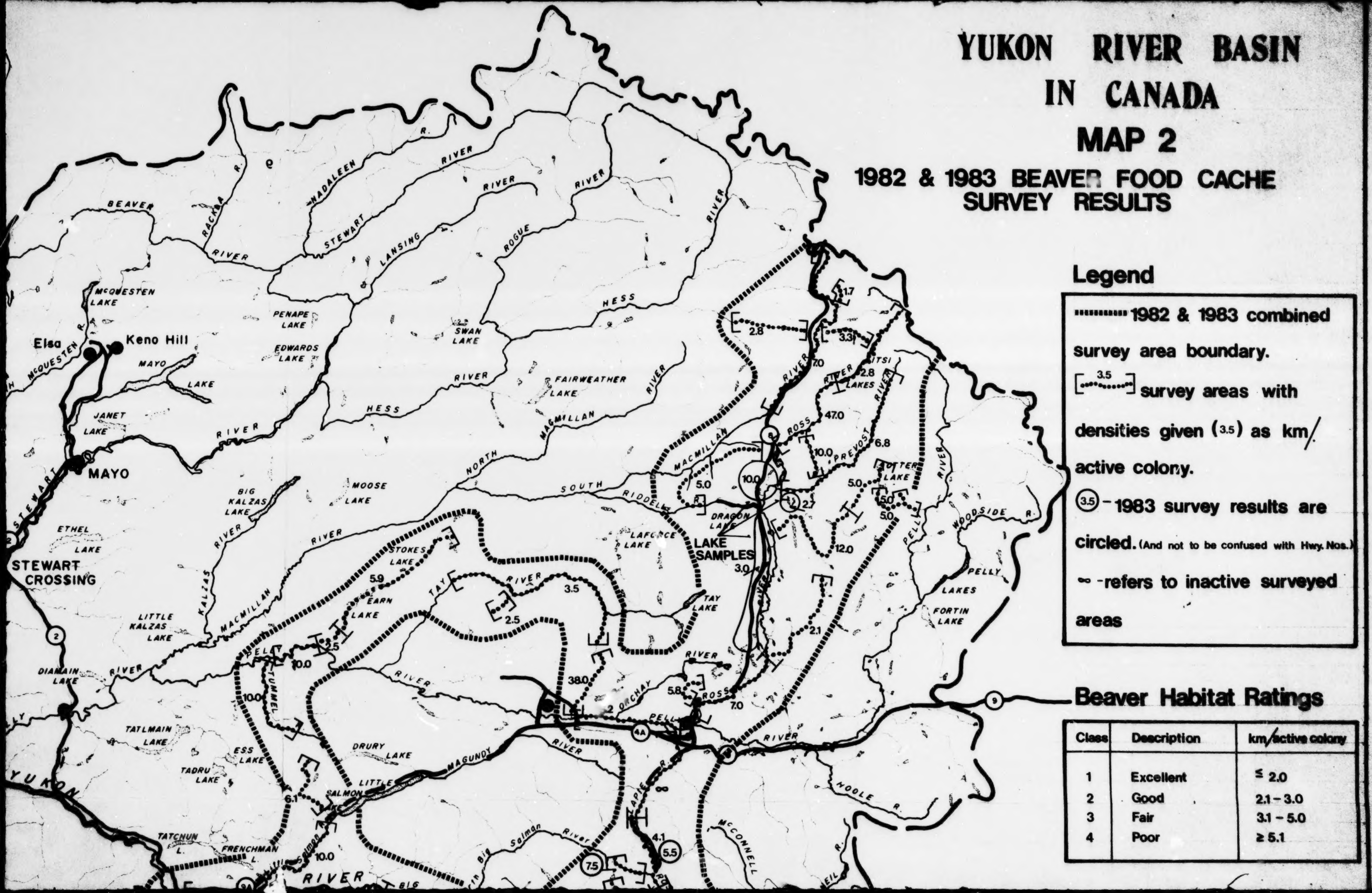


YUKON TERRITORY - CANADA
ALASKA - U.S.A.
YUKON TERRITORY
BRITISH COLUMBIA
Beaver Creek
Burwash Landing
Destruction Bay
HAINES JUNCTION
Carmacks
TATCHUN
WHITE RIVER
DONJEK
KIOTASSIN
KLAZA
NISLING RIVER
KLUANE RIVER
KLUANE LAKE
Wellesley Lake
Tincup Lake
STEVENS LAKE
TATLMAIN LAKE
TADRU LAKE
DRURY LAKE
LITTLE SALMON LAKE
MAGUNDY
FRENCHMAN L.
NORDENSKIOLD
Mandanna L.
Claire L.
FRANK LAKE
COGHLAN LAKE
MILLER LAKE
TESLIN
Fox Lake
LABERGE
Long Lake
Taye Lake
Jo-Jo Lake
IBEX
Fish Lake
Alligator Lake
Primrose Lake
KUSAWA LAKE
TAKHINI
WATSON
WHEATON
1
2
4
9A


TATLMAIN LAKE
ESS LAKE
TATCHUN
FRENCHMAN L.
DRURY LAKE
LITTLE SALMON LAKE
MAGUNDY
RIVER
PELLY
HOOLE R.
LAPIE R.
ROSE
McCONNELL R.
NISUTLIN
McNEIL R.
Carmacks
NORDENSKIOLD
Mandanna L.
Claire L.
BIG SALMON
North Big Salmon River
South Big Salmon R.
Big Salmon Lake
QUIET LAKE
FRANK LAKE
COGHLAN LAKE
MILES LAKE
TESLIN
BOSWELL RIVER
Fox Lake
Lake LABERGE
Long Lake
WOLF LAKE
WOLF RIVER
MORRIS
SWIFT R.
RIVER
YUKON
B.C.
MARY R.
MARY LAKE
McCLINTOCK
WHITEHORSE
MARSH
SQUANGA LAKE
DALAYEE
Little Atlin Lake
TESLIN
IBEX
Fish Lake
Taye Lake
Jo-Jo Lake
HAINES JUNCTION
Alligator Lake
WATSON
WHEATON
PRIMROSE
KUSAWA LAKE
TAKHINI
Primrose Lake
BENNETT LAKE
CARCROSS
TAGISH
Tutshi Lake
Bennett
ATLIN
SURPRISE LAKE
GLADYS LAKE
SWAN L.
NOME L.
SWIFT
LAKE
JENNINGS RIVER
HOYT R.
TESLIN R.
JUDAHNDA R.
YUKON TERRITORY
BRITISH COLUMBIA
1
2
4
4A
9A
0 10 20 30 40 50 60 70
SCALE IN MILES
140 139 141 142 143 144 147 151 152 153 154 155 159 163 164 165 166 167 168 170 171 172
195 196 197 198 200 201 202 203 204 205 206 207 208 209 211 212 213 214 215 216 217 218 219 220 222 223 224 225 226 227 228 229 230 231 234 235 236 237 238 239 240 241 242 243 244 245
268 269 270 275 276 277 279 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 324 325 326 327 328 329 330 331 332 334 336 337 338 339 342 343 344 345
500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 520 521 522 523 524 525 526 527



N
YUKON
FIFTEEN MILE R.
CHANDINDU
RIVER
11
NORTH KLONDIKE RIVER
KLONDIKE
DAWSON
RIVER
3
SIXTY MILE
RIVER
INDIAN
RIVER
RIVER
STEWART
NORTH LADUE R.
RIVER
WHITE RIVER
NORTH McQUESTEN R.
McQUESTEN RIVER
SOUTH McQUESTEN R.
McQUESTEN LAKE
Elsa
Keno Hill
MAYO
LAKE
JANET LAKE
MAYO
STEWART
2
STEWART CROSSING
REID LAKE
ETHEL LAKE
2
DIAMAIN LAKE
PELLY
YUKON
BEAVER
RIVER
RACKLA R.
NADALEEN R.
STEWART
RIVER
LANSING
RIVER
ROGUE
PENAPE LAKE
EDWARDS LAKE
SWAN LAKE
RIVER
HESS
RIVER
NORTH
BIG KALZAS LAKE
MOOSE LAKE
KALZAS RIVER
MACMILLAN
RIVER
LITTLE KALZAS LAKE
RIVER
STOKES LAKE
5.9
EARN LAKE
TAY
RIVER
2.5
2.5
PELLY
10.0
10.0
TUMMEL
RIVER
TATLMAIN LAKE
ESS LAKE
TADRU LAKE
DRURY LAKE
MAGUNDY
LITTLE SALMON LAKE
6.1
TATCHUN L.
FRENCHMAN L.
Little Salmon
10.0
RIVER
Big Salmon


BEAVER RIVER
RACKLA R.
NADALEEN RIVER
STEWART RIVER
LANSING RIVER
ROGUE RIVER
HESS RIVER
R.
RIVER
McQUESTEN LAKE
McQUESTEN R.
Elsa
Keno Hill
MAYO LAKE
JANET LAKE
MAYO
PENAPE LAKE
EDWARDS LAKE
SWAN LAKE
FAIRWEATHER LAKE
MACMILLAN RIVER
NORTH
SOUTH
BIG KALZAS LAKE
MOOSE LAKE
ETHEL LAKE
STEWART CROSSING
KALZAS RIVER
LITTLE KALZAS LAKE
DIAMAIN LAKE
PELLY RIVER
TATLMAIN LAKE
ESS LAKE
TADRU LAKE
YUKON
TATCHUN L.
FRENCHMAN L.
STOKES LAKE
EARN LAKE
TAY RIVER
TAY LAKE
TUMMEL
DRURY LAKE
LITTLE SALMON
MAGUNDY RIVER
Big Salmon River
RIVER
BIG
LAPIE R.
McCONNELL
HOOLE R.
ORCHAY
ROSS RIVER
RIDDELL
DRAGON LAKE
LAFORCE LAKE
LAKE SAMPLES
ITSI LAKES
PREVOST RIVER
OTTER LAKE
WOODSIDE R.
PELLY LAKES
FORTIN LAKE
1.7
2.8
3.3
7.0
2.8
47.0
6.8
10.0
10.0
5.0
5.0
2.7
5.0
5.0
12.0
3.0
2.1
5.9
3.5
2.5
2.5
10.0
10.0
38.0
2
5.8
7.0
6.1
10.0
4.1
5.5
7.5
∞
2
4A
9

YUKON RIVER BASIN IN CANADA

MAP 2

1982 & 1983 BEAVER FOOD CACHE SURVEY RESULTS

Legend

▪▪▪▪▪▪▪▪ 1982 & 1983 combined survey area boundary.

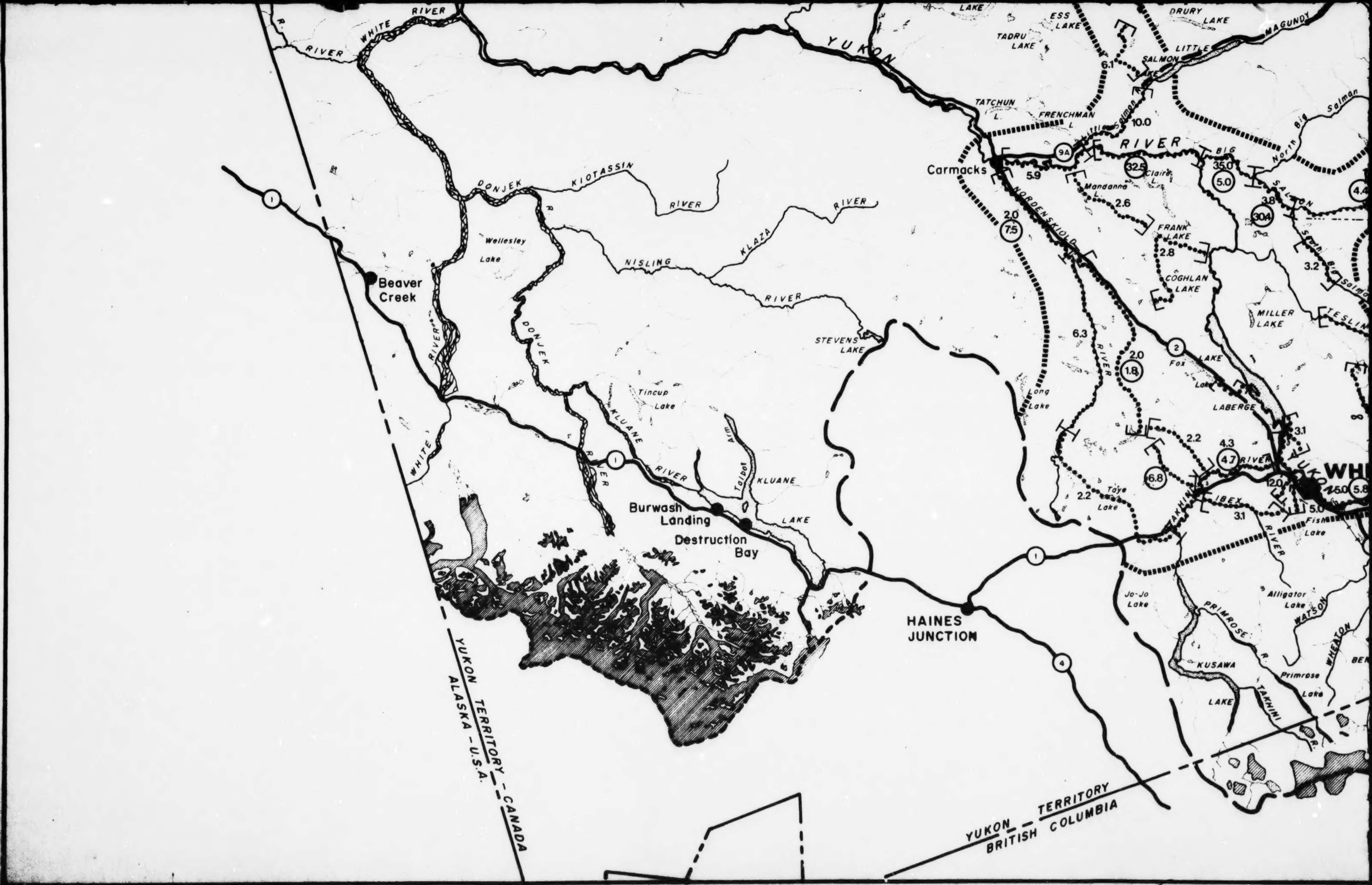
[³·⁵ •••••••] survey areas with densities given (3.5) as km/active colony.

③.⑤ - 1983 survey results are circled. (And not to be confused with Hwy. Nos.)

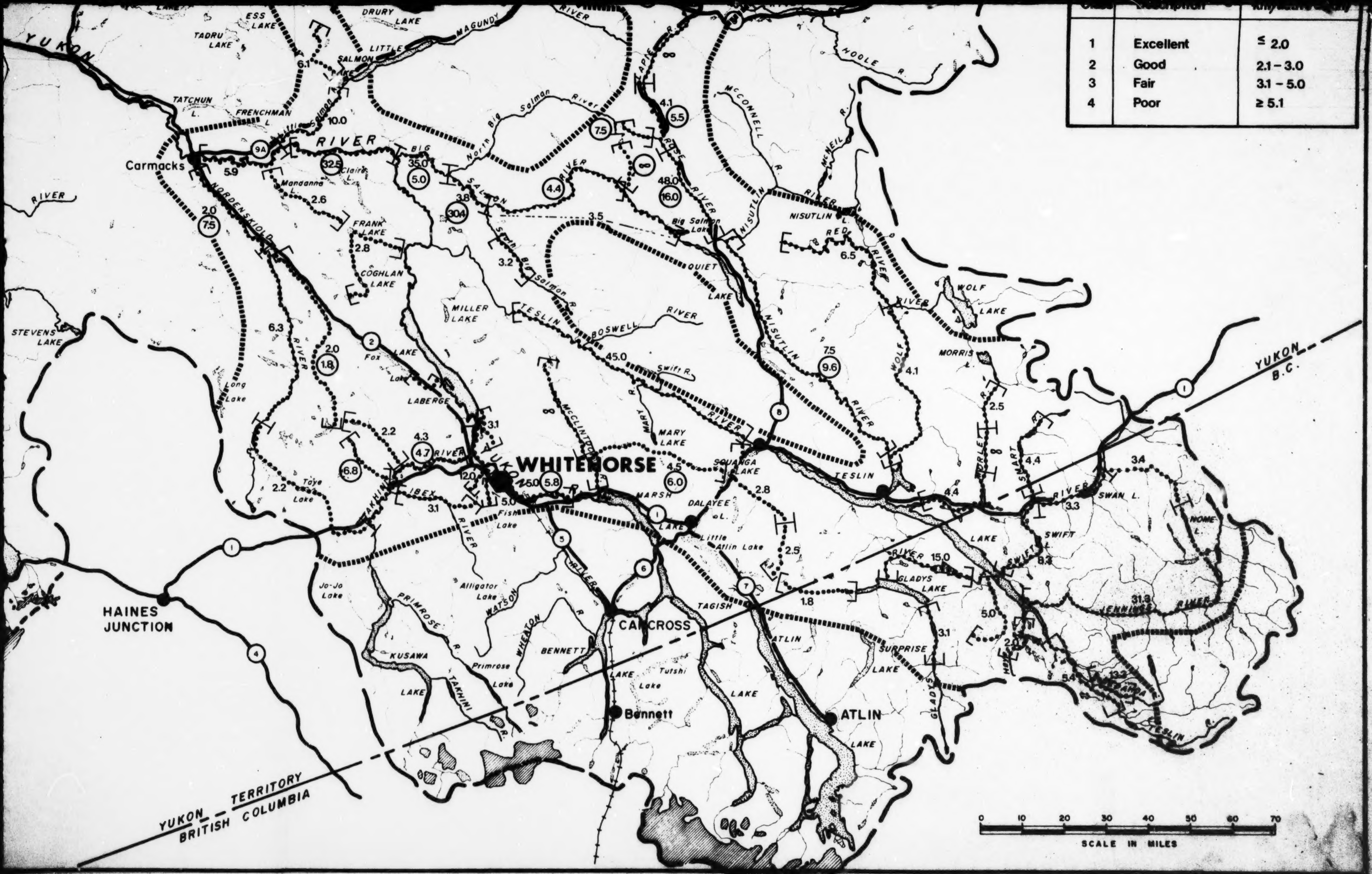
∞ - refers to inactive surveyed areas

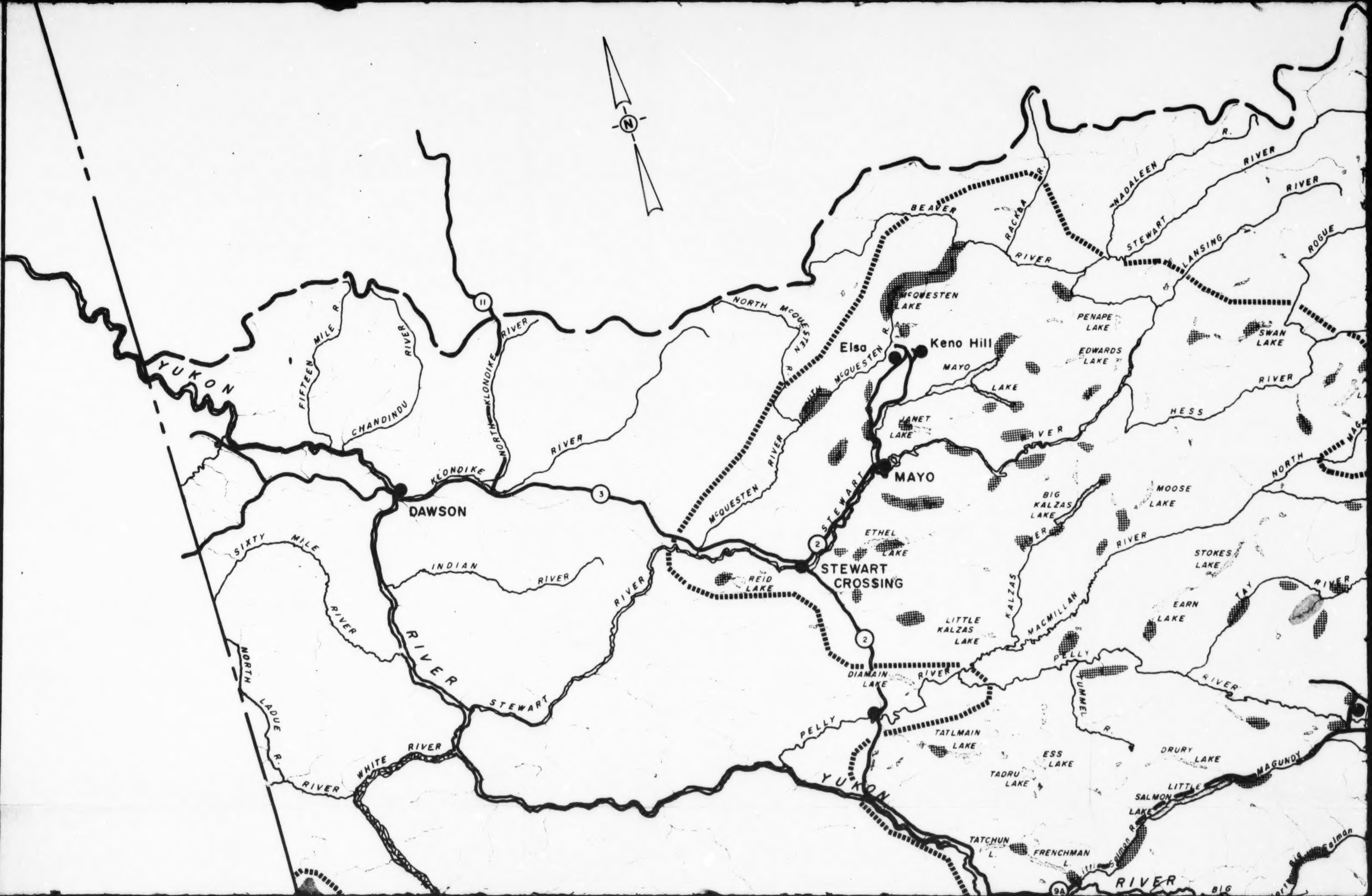
Beaver Habitat Ratings

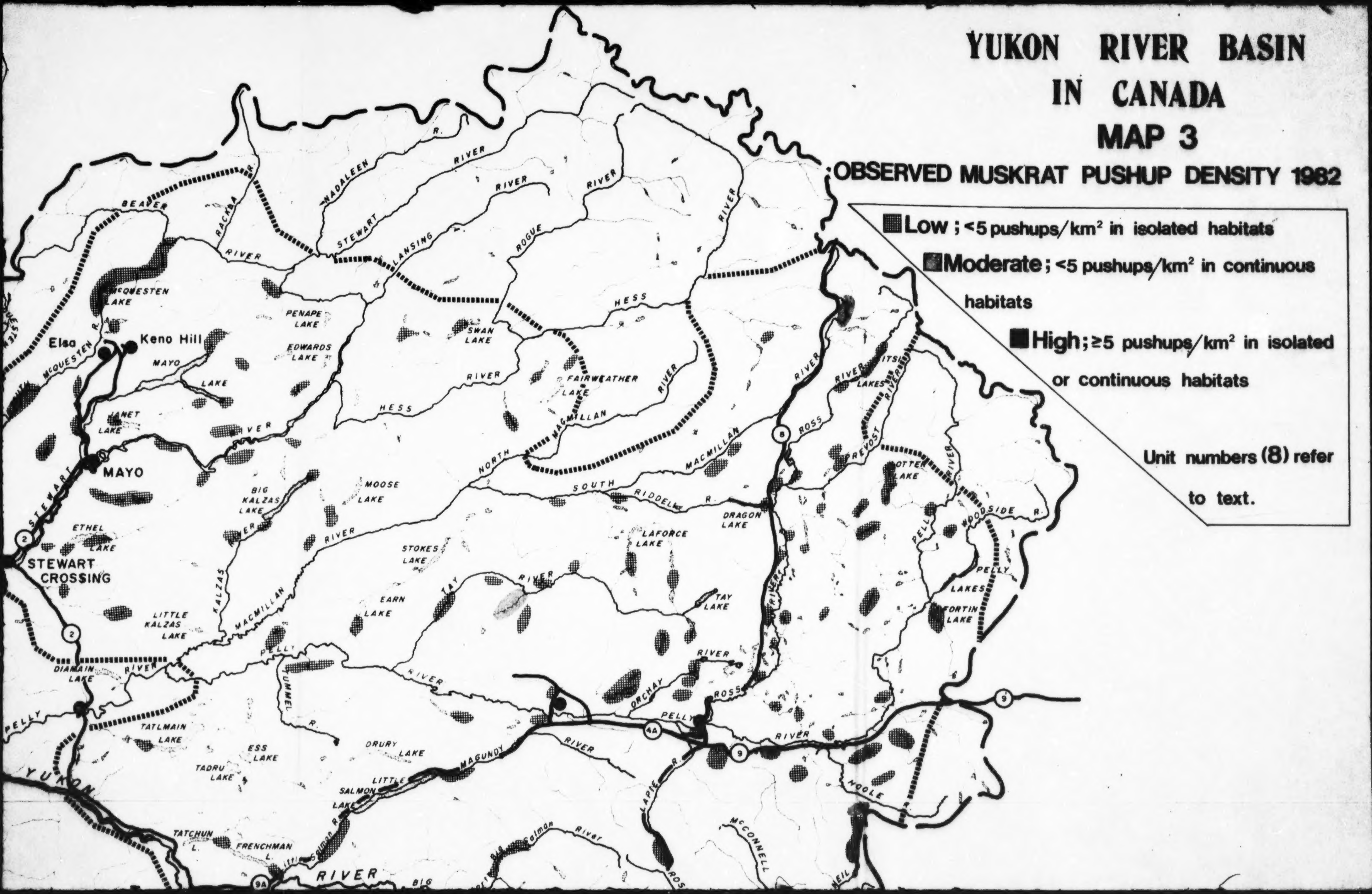
Class	Description	km/active colony
1	Excellent	≤ 2.0
2	Good	2.1 – 3.0
3	Fair	3.1 – 5.0
4	Poor	≥ 5.1



WHITE RIVER
DONJEK
KIOTASSIN
RIVER
KLAZA
RIVER
YUKON
Wellesley Lake
NISLING
RIVER
Beaver Creek
RIVER
WHITE
DONJEK
STEVENS LAKE
Tincup Lake
KLUANE
RIVER
Talbot Arm
KLUANE
LAKE
Burwash Landing
Destruction Bay
HAINES JUNCTION
1
4
2
YUKON TERRITORY - CANADA
ALASKA - U.S.A.
YUKON TERRITORY
BRITISH COLUMBIA
TADRU LAKE
ESS LAKE
DRURY LAKE
MAGUNDY
LITTLE SALMON LAKE
TATCHUN L.
FRENCHMAN L.
Little Salmon
RIVER
Carmacks
9A
32.5
35.0
5.0
30A
7.5
1.8
4.7
6.8
6.1
10.0
5.9
2.0
2.6
3.8
2.8
3.2
6.3
2.2
4.3
3.1
5.0
5.8
Mandanna L.
Claire L.
NORDENSKIOLD RIVER
FRANK LAKE
COGHLAN LAKE
BIG SALMON
North Big Salmon
South Big Salmon
MILLER LAKE
TESLIN
Fox Lake
LABERGE
Long Lake
Taye Lake
IBEX RIVER
TAKHINI
RIVER
Fish Lake
Jo-Jo Lake
Alligator Lake
PRIMROSE R.
WATSON
WHEATON
KUSAWA LAKE
Primrose Lake
TAKHINI R.
WH


1 Excellent ≤ 2.0
2 Good 2.1 – 3.0
3 Fair 3.1 – 5.0
4 Poor ≥ 5.1
YUKON
ESS LAKE
TADRU LAKE
DRURY LAKE
LITTLE SALMON LAKE
MAGUNDY
RIVER
TATCHUN L.
FRENCHMAN L.
Little Salmon
RIVER
Carmacks
NORDENSKIOLD
Mandanna L.
Claire L.
FRANK LAKE
COGHLAN LAKE
BIG SALMON
North Big Salmon River
South Big Salmon R.
Big Salmon Lake
QUIET LAKE
ROSE RIVER
LAPIE R.
HOOLE R.
McCONNELL R.
McNEIL R.
NISUTLIN RIVER
NISUTLIN L.
RED RIVER
WOLF RIVER
WOLF LAKE
MORRIS L.
MILLER LAKE
TESLIN
BOSWELL RIVER
Swift R.
MARY R.
MARY LAKE
McCLINTOCK
Fox Lake
LABERGE
WHITEHORSE
YUKON
STEVENS LAKE
Long Lake
Taye Lake
TAKHINI
IBEX RIVER
Fish Lake
MARSH LAKE
SQUANGA LAKE
DALAYEE L.
Little Atlin Lake
TESLIN LAKE
SMART R.
MORLEY R.
SWAN L.
NOME L.
SWIFT RIVER
GLADYS LAKE
JENNINGS RIVER
SURPRISE LAKE
GLADYS R.
HALL
TESLIN
Jo-Jo Lake
HAINES JUNCTION
PRIMROSE R.
Primrose Lake
KUSAWA LAKE
TAKHINI R.
Alligator Lake
WATSON
WHEATON
BENNETT LAKE
CARCROSS
Tutshi Lake
TAGISH LAKE
ATLIN LAKE
ATLIN
Bennett
YUKON TERRITORY
BRITISH COLUMBIA
YUKON
B.C.
RIVER
1
2
4
5
6
7
8
9A
6.1
10.0
5.9
32.5
35.0
5.0
7.5
4.1
5.5
4.4
3.8
30.4
48.0
16.0
3.5
2.6
2.0
7.5
2.8
3.2
6.5
7.5
9.6
4.1
45.0
6.3
2.0
1.8
3.1
2.2
4.3
4.7
6.8
2.2
3.1
12.0
5.0
5.8
4.5
6.0
2.8
2.5
2.5
4.4
4.4
3.4
3.3
8.3
15.0
1.8
5.0
3.1
2.0
31.3
13.3
5.4
0 10 20 30 40 50 60 70
SCALE IN MILES


N
11
YUKON
FIFTEEN MILE R.
CHANDINDU RIVER
NORTH KLONDIKE RIVER
KLONDIKE
RIVER
DAWSON
3
SIXTY MILE RIVER
INDIAN RIVER
STEWART RIVER
RIVER
NORTH LADUE R.
WHITE RIVER
RIVER
NORTH McQUESTEN R.
McQUESTEN R.
McQUESTEN RIVER
BEAVER
RACKLA R.
RIVER
McQUESTEN LAKE
Elsa
Keno Hill
MAYO LAKE
JANET LAKE
RIVER
MAYO
STEWART
2
ETHEL LAKE
STEWART CROSSING
REID LAKE
2
LITTLE KALZAS LAKE
BIG KALZAS LAKE
KALZAS RIVER
PENAPE LAKE
EDWARDS LAKE
NADALEEN R.
STEWART RIVER
LANSING RIVER
ROGUE
SWAN LAKE
HESS RIVER
NORTH MAC
MOOSE LAKE
MACMILLAN RIVER
STOKES LAKE
EARN LAKE
TAY RIVER
PELLY RIVER
DIAMAIN LAKE
PELLY
TUMMEL R.
RIVER
TATLMAIN LAKE
ESS LAKE
TADRU LAKE
DRURY LAKE
YUKON
LITTLE SALMON LAKE
MAGUNDY
Little Salmon R.
TATCHUN L.
FRENCHMAN L.
9A
RIVER
BIG
Big Salmon

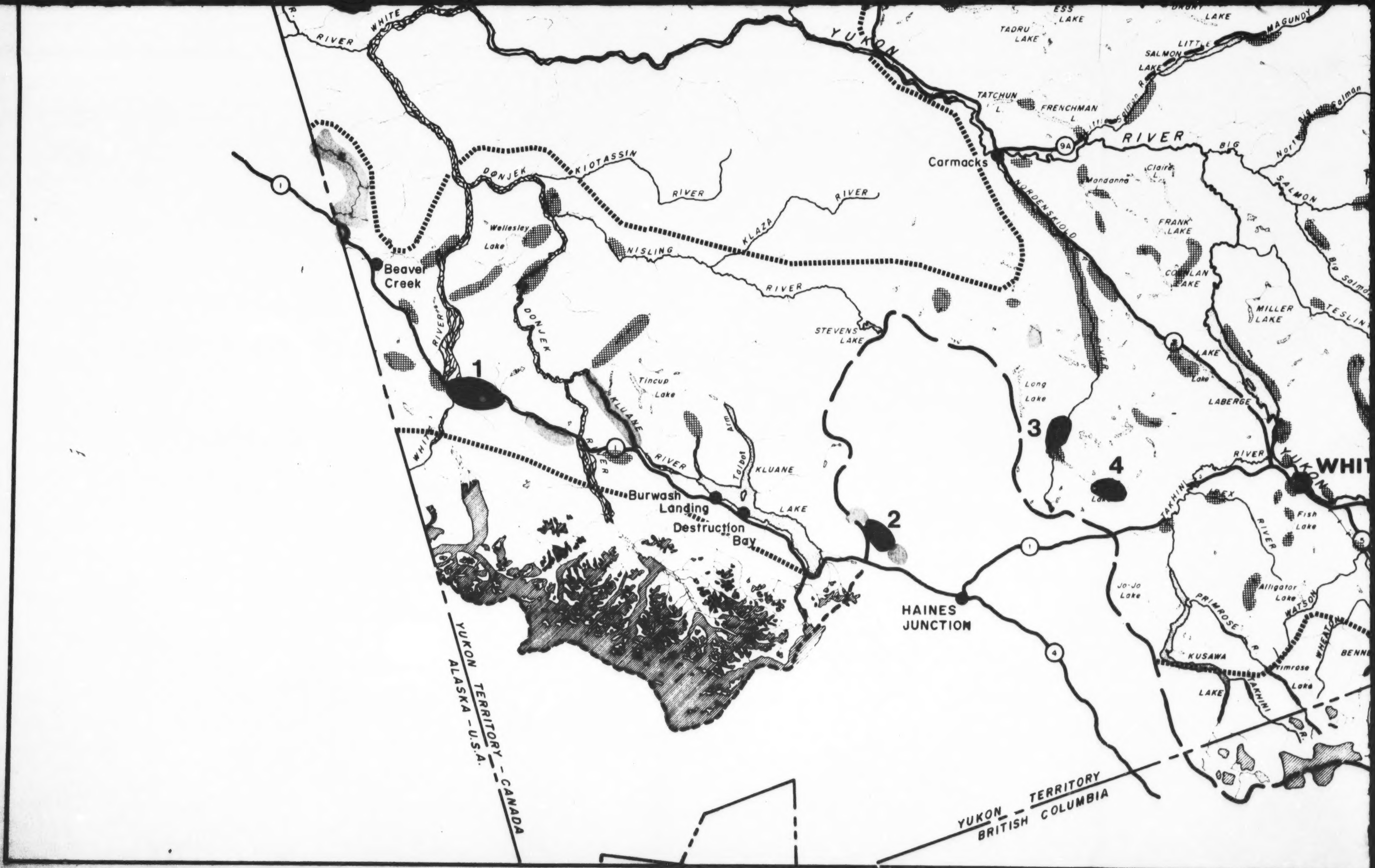


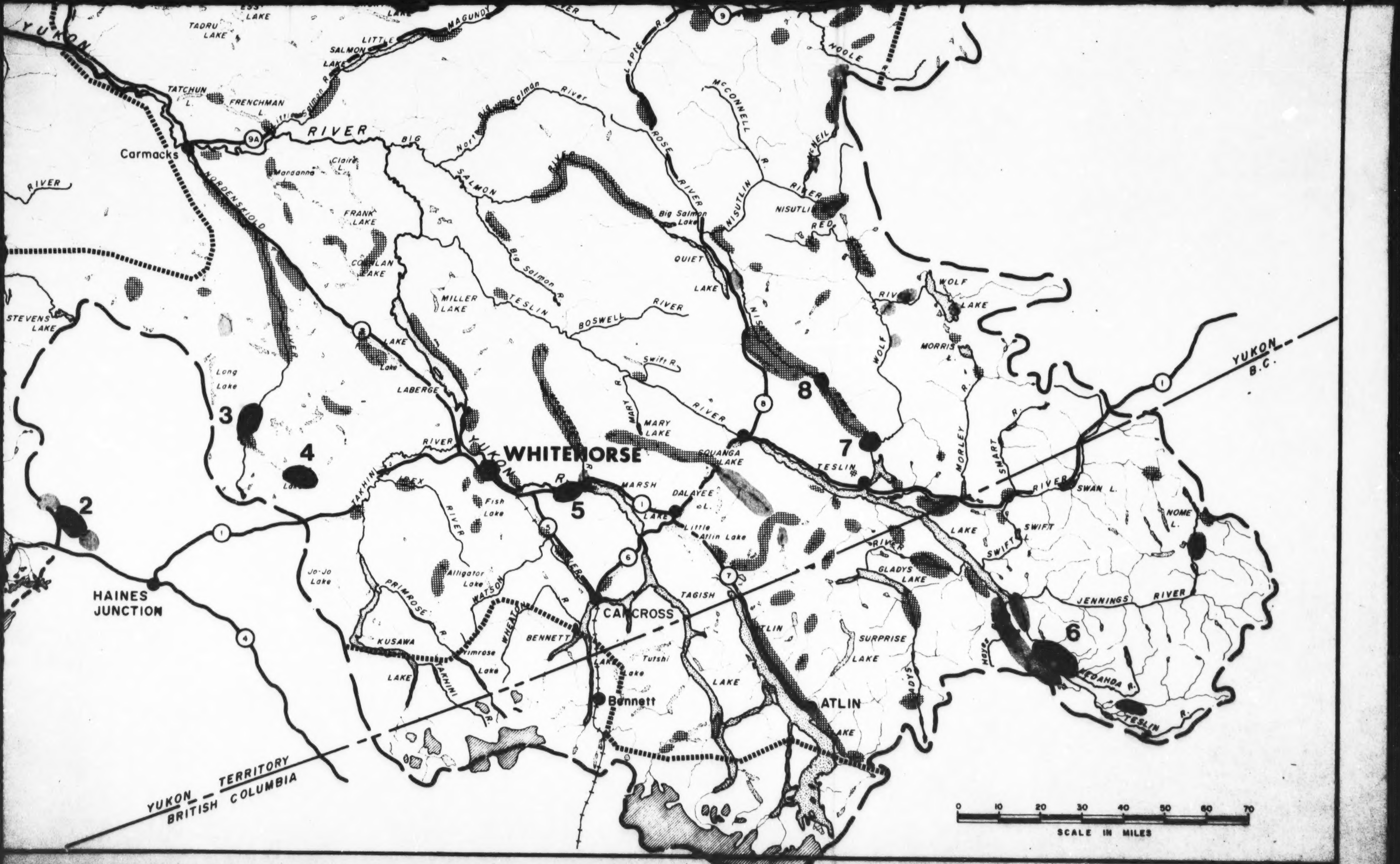
YUKON RIVER BASIN IN CANADA

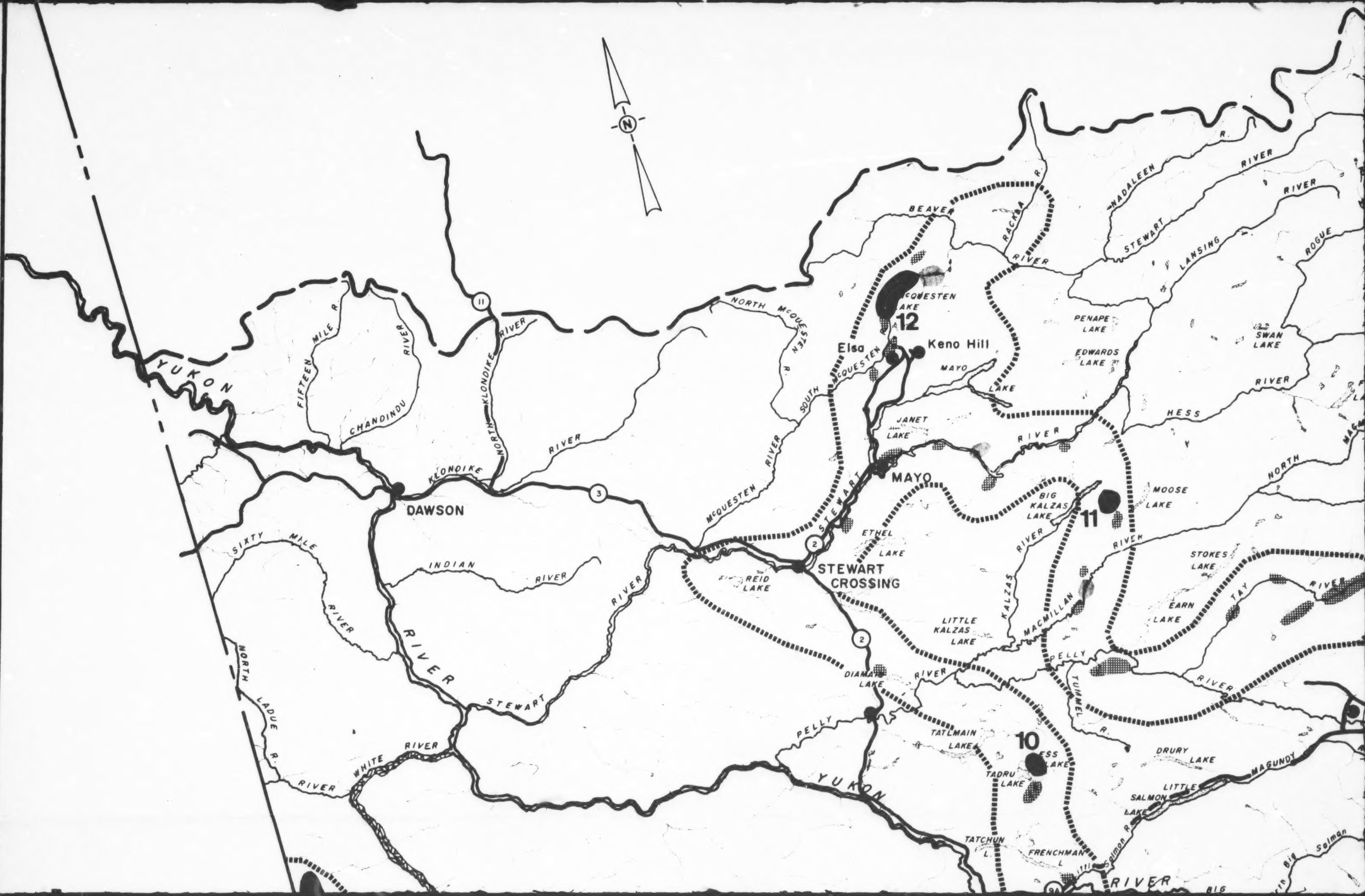
MAP 3

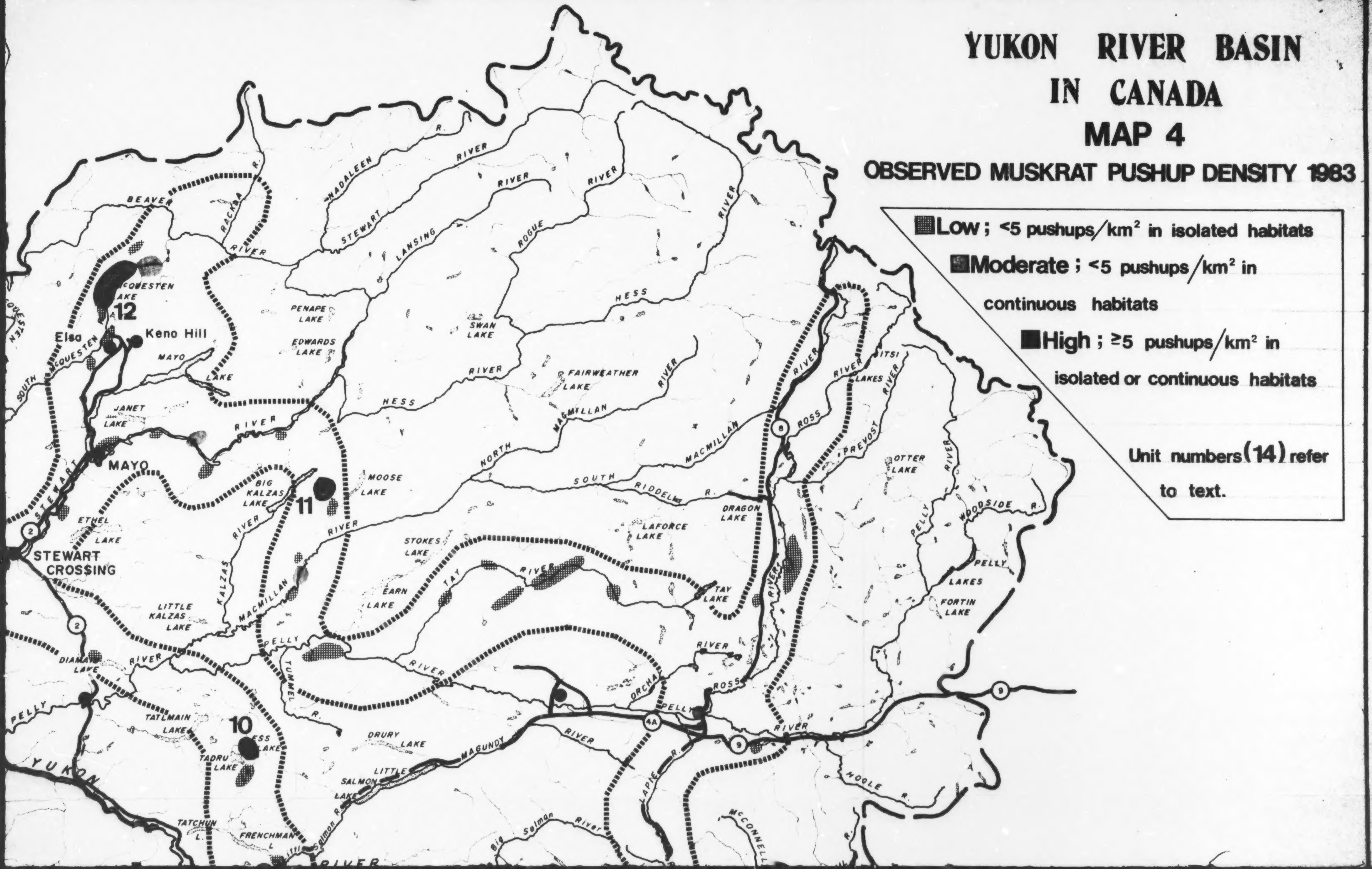
OBSERVED MUSKRAT PUSHUP DENSITY 1982

▨ Low ; <5 pushups/km² in isolated habitats
▨ Moderate ; <5 pushups/km² in continuous habitats
■ High ; ≥5 pushups/km² in isolated or continuous habitats
Unit numbers (8) refer to text.
BEAVER RIVER
RACKLA R.
MCQUESTEN LAKE
MCQUESTEN R.
Elsa
Keno Hill
MAYO LAKE
JANET LAKE
MAYO
STEWART
ETHEL LAKE
STEWART CROSSING
2
LITTLE KALZAS LAKE
KALZAS
BIG KALZAS LAKE
DIAMAIN LAKE
PELLY
TATLMAIN LAKE
ESS LAKE
TADRU LAKE
YUKON
TATCHUN L.
FRENCHMAN L.
9A
RIVER
LITTLE SALMON LAKE
Little Salmon R.
Big Salmon River
BIG
MADALEEN R.
STEWART RIVER
LANSING RIVER
ROGUE RIVER
HESS RIVER
PENAPE LAKE
EDWARDS LAKE
SWAN LAKE
FAIRWEATHER LAKE
NORTH MACMILLAN RIVER
MOOSE LAKE
SOUTH MACMILLAN
MACMILLAN RIVER
RIDDELL R.
DRAGON LAKE
LAFORCE LAKE
STOKES LAKE
EARN LAKE
TAY RIVER
TAY LAKE
ORCHAY RIVER
HUMMEL
DRURY LAKE
MAGUNDY RIVER
4A
PELLY RIVER
9
LAPIE R.
MCCONNELL
ROSS RIVER
8
RIVER
ITSI LAKES
PREVOST RIVER
OTTER LAKE
RIVER
WOODSIDE R.
PELLY
PELLY LAKES
FORTIN LAKE
HOOLE
NEIL


WHITE RIVER
YUKON
ESS LAKE
TADRU LAKE
DRURY LAKE
LITTLE SALMON LAKE
MAGUNDY
TATCHUN L.
FRENCHMAN L.
Little Salmon R.
9A
RIVER
Carmacks
BIG SALMON
Big Salmon
North Big Salmon
Mandanna
Claire L.
NORDENSKIOLD
FRANK LAKE
CORLAN LAKE
MILLER LAKE
TESLIN
DONJEK
KIOTASSIN
RIVER
KLAZA RIVER
Wellesley Lake
NISLING RIVER
Beaver Creek
1
WHITE RIVER
DONJEK
STEVENS LAKE
Tincup Lake
KLUANE RIVER
Talbot Arm
KLUANE LAKE
Long Lake
3
4
LAKE
LABERGE
RIVER
YUKON
WHIT
Burwash Landing
Destruction Bay
2
TAKHINI
IBEX RIVER
Fish Lake
HAINES JUNCTION
Jo-Jo Lake
Alligator Lake
PRIMROSE R.
WATSON
KUSAWA LAKE
TAKHINI R.
Primrose Lake
WHEATON
BENNE
4
YUKON TERRITORY - CANADA
ALASKA - U.S.A.
YUKON TERRITORY
BRITISH COLUMBIA


YUKON
TADRU LAKE
LAKE
LITTLE
SALMON
LAKE
MAGUNDY
TATCHUN L.
FRENCHMAN L.
Little Salmon R.
9A
RIVER
Carmacks
RIVER
NORDENSKIOLD
Mandanna
Claire L.
FRANK LAKE
COGHLAN LAKE
BIG
SALMON
North Big Salmon River
Big Salmon R.
MILLER LAKE
TESLIN
BOSWELL
RIVER
LAPIE R.
9
ROSE
RIVER
McCONNELL
R.
NISUTLIN
Big Salmon Lake
QUIET
LAKE
McNEIL
RIVER
NISUTLIN
RED
NOOLE
WOLF
RIVER
WOLF LAKE
MORRIS L.
MORLEY R.
STEVENS LAKE
Long Lake
3
4
Lake
2
LAKE
Lake
LABERGE
RIVER
YUKON
WHITEHORSE
R.
5
Swift R.
MARY R.
MARY LAKE
RIVER
8
8
7
SQUANGA LAKE
TESLIN
MARSH
1
DALAYEE L.
LAKE
Little Atlin Lake
TAKHINI
IBEX
RIVER
Fish Lake
Alligator Lake
1
HAINES JUNCTION
4
Jo-Jo Lake
PRIMROSE
R.
WATSON
WHEATON
5
6
7
TAGISH
CARCROSS
BENNETT
Tutshi Lake
LAKE
KUSAWA
LAKE
TAKHINI
Primrose Lake
R.
Bennett
LAKE
ATLIN
ATLIN
LAKE
SURPRISE LAKE
GLADYS LAKE
GLADYS
RIVER
SWIFT
SWIFT L.
LAKE
SMART R.
RIVER
SWAN L.
NOME L.
JENNINGS RIVER
6
Hayes
HEDANDA R.
TESLIN R.
YUKON
B.C.
1
YUKON TERRITORY
BRITISH COLUMBIA
0 10 20 30 40 50 60 70
SCALE IN MILES


N
YUKON
FIFTEEN MILE R.
CHANDINDU RIVER
CHANDINDU
11
NORTH KLONDIKE RIVER
KLONDIKE
RIVER
DAWSON
3
NORTH McQUESTEN R.
SOUTH McQUESTEN
McQUESTEN RIVER
BEAVER
RACKLA R.
RIVER
McQUESTEN LAKE
12
Elsa
Keno Hill
MAYO LAKE
MAYO
JANET LAKE
RIVER
PENAPE LAKE
EDWARDS LAKE
WAD ALEEN R.
STEWART RIVER
LANSING RIVER
RIVER
ROGUE
SWAN LAKE
RIVER
HESS
NORTH
STEWART
2
STEWART CROSSING
REID LAKE
ETHEL LAKE
BIG KALZAS LAKE
11
MOOSE LAKE
RIVER
KALZAS RIVER
LITTLE KALZAS LAKE
MACMILLAN
STOKES LAKE
EARN LAKE
TAY
RIVER
SIXTY MILE RIVER
INDIAN RIVER
RIVER
STEWART
RIVER
NORTH LADUE R.
RIVER
WHITE RIVER
PELLY
YUKON
DIAMAIN LAKE
RIVER
PELLY
TUMMEL R.
RIVER
TATLMAIN LAKE
10
TADRU LAKE
ESS LAKE
DRURY LAKE
LITTLE
MAGUNDY
SALMON LAKE
Salmon R.
TATCHUN L.
FRENCHMAN L.
RIVER
Little Salmon
Big Salmon
BIG



YUKON RIVER BASIN IN CANADA

MAP 4

OBSERVED MUSKRAT PUSHUP DENSITY 1983

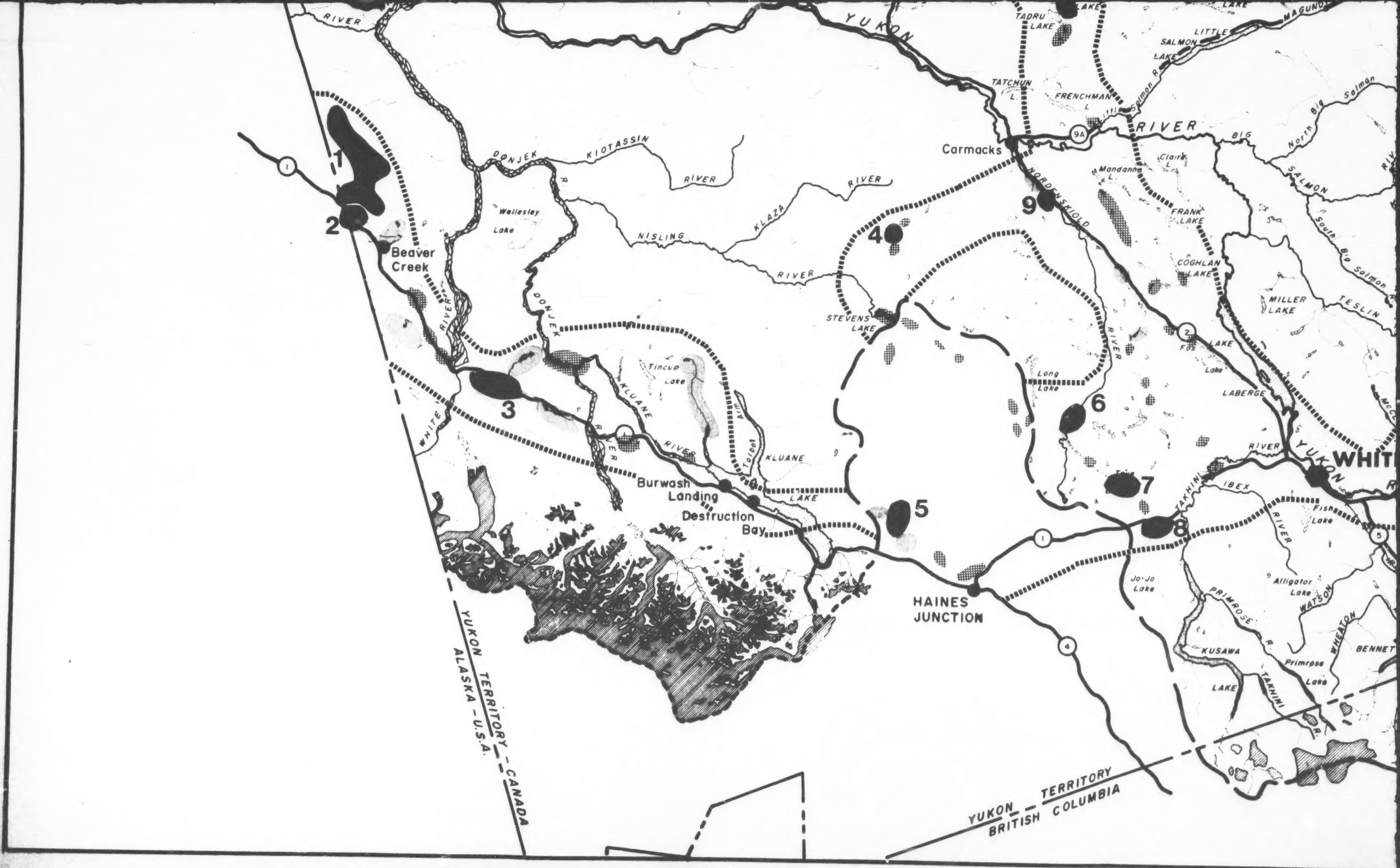
▨ **Low** ; <5 pushups/km² in isolated habitats

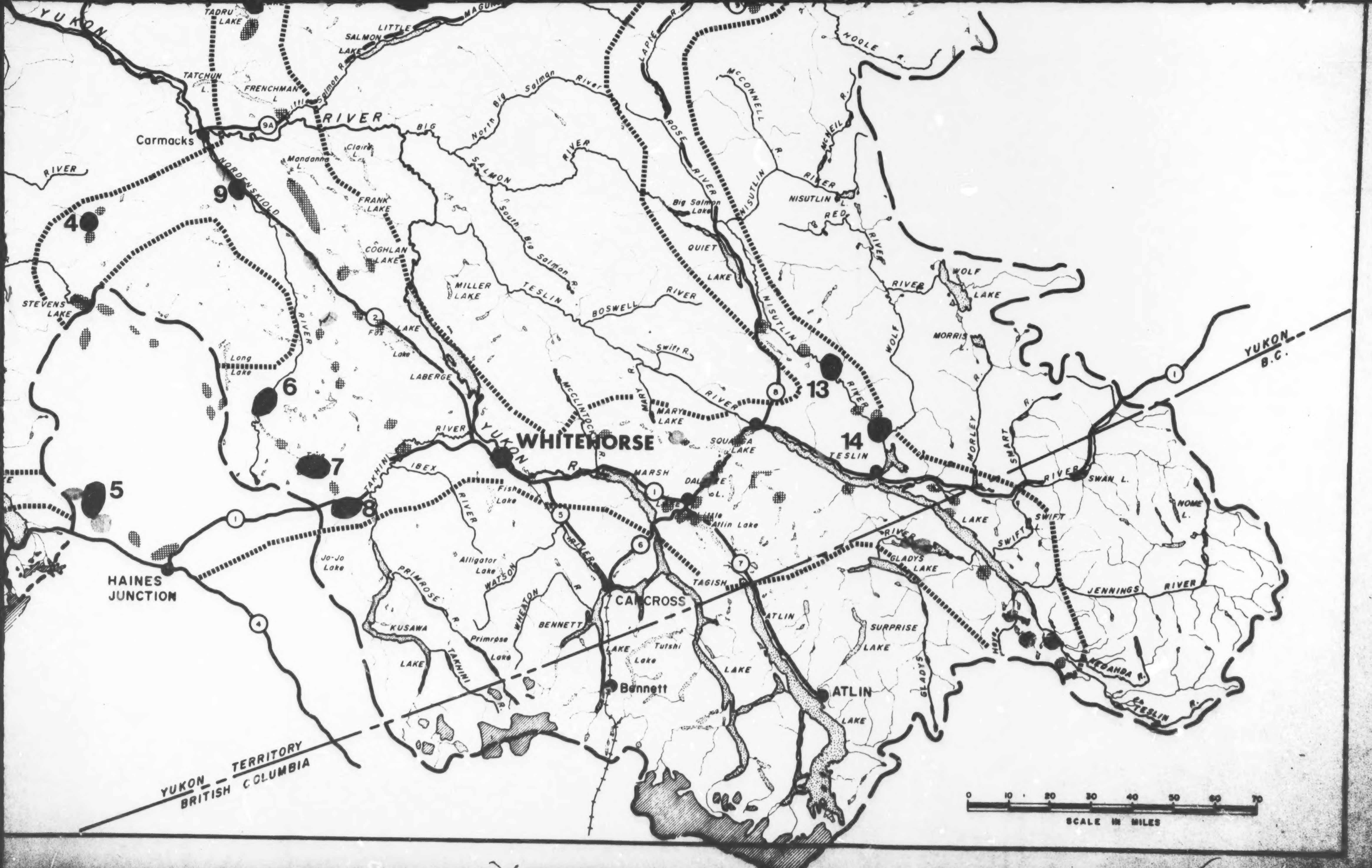
▨ **Moderate** ; <5 pushups/km² in continuous habitats

■ **High** ; ≥5 pushups/km² in isolated or continuous habitats

Unit numbers (14) refer to text.

BEAVER
RACKLA R.
RIVER
NADALEEN
STEWART
RIVER
R.
LANSING
RIVER
ROGUE
RIVER
RIVER
RIVER
HESS
McQUESTEN LAKE
12
Elsa
Keno Hill
SOUTH McQUESTEN
MAYO LAKE
PENAPE LAKE
EDWARDS LAKE
SWAN LAKE
FAIRWEATHER LAKE
MACMILLAN
RIVER
HESS
RIVER
HESS
JANET LAKE
RIVER
MAYO
STEWART
BIG KALZAS LAKE
11
MOOSE LAKE
NORTH
SOUTH
MACMILLAN
RIDDELL R.
DRAGON LAKE
ROSS
RIVER
RIVER
ITSI LAKES
RIVER
PREVOST
OTTER LAKE
RIVER
WOODSIDE R.
PELLY
PELLY LAKES
FORTIN LAKE
2
ETHEL LAKE
STEWART CROSSING
KALZAS
RIVER
RIVER
STOKES LAKE
LAFORCE LAKE
TAY
RIVER
TAY LAKE
EARN LAKE
MACMILLAN
LITTLE KALZAS LAKE
2
PELLY
DIAMAIN LAKE
RIVER
TUMMEL R.
RIVER
RIVER
ORCHAY
ROSS
PELLY
RIVER
PELLY
TATLMAIN LAKE
10
JESS LAKE
TADRU LAKE
YUKON
DRURY LAKE
MAGUNDY
RIVER
4A
LAPIE R.
9
RIVER
9
8
HOOLE R.
LITTLE SALMON LAKE
Little Salmon River
TATCHUN L.
FRENCHMAN L
RIVER
Big Salmon River
McCONNELL
R.


RIVER
YUKON
TADRU LAKE
LAKE
LITTLE SALMON LAKE
MAGUNDY
TATCHUN L.
FRENCHMAN L.
Little Salmon R.
RIVER
North Big Salmon
9A
Carmacks
BIG SALMON
DONJEK
KIOTASSIN
RIVER
KLAZA
RIVER
Mandanna L.
Claire L.
1
2
Beaver Creek
Wellesley Lake
NISLING
RIVER
NORDENSKIOLD
9
4
FRANK LAKE
South Big Salmon
COGHLAN LAKE
MILLER LAKE
TESLIN
STEVENS LAKE
RIVER
DONJEK
2
Fox LAKE
Fox Lake
Tincup Lake
Long Lake
6
LABERGE
3
KLUANE
Talbot Arm
KLUANE
RIVER
RIVER
YUKON
WHITE
WHITE
1
RIVER
Burwash Landing
Destruction Bay
LAKE
5
7
TAKHINI
IBEX
RIVER
8
Fish Lake
5
1
HAINES JUNCTION
Jo-Jo Lake
Alligator Lake
PRIMROSE R.
WATSON
WHEATON
BENNET
4
KUSAWA LAKE
TAKHINI
Primrose Lake
R.
YUKON TERRITORY - CANADA
ALASKA - U.S.A.
YUKON TERRITORY
BRITISH COLUMBIA


YUKON
TADRU LAKE
LITTLE SALMON LAKE
MAGUNDY
HOOLE R.
LAPIE R.
TATCHUN L.
FRENCHMAN L.
Little Salmon R.
Big Salmon River
McCONNELL R.
9A
RIVER
BIG
North Big Salmon River
ROSE RIVER
McNEIL R.
Carmacks
Claire L.
Mandanna L.
SALMON
RIVER
NISUTLIN
RIVER
NORDENSKIOLD
9
4
FRANK LAKE
Big Salmon Lake
NISUTLIN L.
RED
RIVER
COGHLAN LAKE
South Big Salmon R.
QUIET LAKE
MILLER LAKE
TESLIN
BOSWELL
RIVER
WOLF RIVER
WOLF LAKE
STEVENS LAKE
RIVER
2
Fox LAKE
Lake
Swift R.
NISUTLIN
MORRIS L.
Long Lake
LABERGE
McCLINTOCK R.
MARY R.
13
RIVER
8
6
MARY LAKE
14
YUKON
B.C.
1
RIVER
YUKON
WHITEHORSE
SQUANGA LAKE
TESLIN
MORLEY
SMART R.
7
TAKHINI
IBEX
R.
MARSH
DALTON L.
SWAN L.
NOME L.
5
8
Fish Lake
RIVER
1
Lake
Little Atlin Lake
LAKE
SWIFT
SWIFT
1
5
RIVER
GLADYS LAKE
Jo-Jo Lake
6
Alligator Lake
7
HAINES JUNCTION
WATSON
TAGISH
JENNINGS RIVER
PRIMROSE R.
WHEATON R.
CARCROSS
KUSAWA
4
BENNETT
ATLIN
SURPRISE LAKE
Primrose Lake
LAKE
Tutshi Lake
LAKE
TAKHINI
LAKE
GLADYS
Hayes
TEGANDA R.
Bennett
ATLIN
TESLIN R.
LAKE
YUKON TERRITORY
BRITISH COLUMBIA
0
10
20
30
40
50
60
70
SCALE IN MILES